MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

Department of Environmental, Water Resources, and Coastal Engineering (EWCE)

COURSE CURRICULUM FOR UNDERGRADUATE PROGRAM

2024

Contents

Committee of Courses
EWCE Department, MIST

The under-graduation course curriculum for the department of Environmental, Water Resources, and Coastal Engineering (EWCE) of Military Institute of Science and Technology (MIST) has been reviewed by the committee as mentioned below.

President:

....
Colonel Md Shamim Iftakhar, NUP, PBGMS
Head
Department of Environmental, Water Resources, and Coastal Engineering (EWCE)

Members (Internal):

1. ....
Colonel Nasir Uddin Ahmed
Dean
Faculty of Civil Engineering

2. ....
Brigadier General (Retired.) Md Gazi Ferooz Rahman
Professor
Department of Environmental, Water Resources, and Coastal Engineering (EWCE)

3. ....
Dr. Abul Fazal M. Saleh
Professor
Department of Environmental, Water Resources, and Coastal Engineering (EWCE)

4. ....
Dr. G. M. Jahid Hasan
Professor
Department of Civil Engineering

5. ....
Dr. Md Tauhid-Ur-Rahman
Professor
Department of Civil Engineering

6. ....
Lieutenant Colonel Khondaker Sakil Ahmed, PhD, Peng, Engrs
Associate Professor
Department of Civil Engineering

7. ....
Lieutenant Colonel Mohammed Russedul Islam, PhD
Associate Professor
Department of Civil Engineering
MIST

8. ....
Lieutenant Colonel Md Amirul Islam, PhD
Associate Professor
Department of Science and Humanities, MIST

9. ....
Lieutenant Colonel Md Jafar Sharif, PhD, Sigs
Associate Professor
Department of Science and Humanities, MIST

10. ....
Lieutenant Colonel Mahabubar Rahman Shah, PhD, AEC
Associate Professor
Department of Science and Humanities, MIST

11. ....
Major Md. Soebur Rahman, PhD, PEng, Engrs
Associate Professor
Department of Civil Engineering

12. ....
Major Mohammad Shafiul Azam, PhD, Engrs
Associate Professor
Department of Environmental, Water Resources, and Coastal Engineering (EWCE)

13. ....
Lieutenant Colonel Kazi Shamima Akter, PhD, Engrs
Associate Professor
Department of Environmental, Water Resources, and Coastal Engineering (EWCE)

14. ....
Masud Jahan
Assistant Professor
Department of Science and Humanities, MIST

External Member:

1. ____________________________________
Brigadier General Md Mustafa Kamal, SGP
Dean, Faculty of Science and Technology
Bangladesh University of Professionals (BUP)

2. ____________________________________
Brigadier General Md Mahbubur Rahman Siddiqui, ndc, afwc, psc, Mphil
College of Inspector
Bangladesh University of Professionals (BUP)

3. ____________________________________
Dr. Md Ashraf Ali
Professor
Department of Civil Engineering
Bangladesh University of Engineering & Technology (BUET)

4. ____________________________________
Dr. Md. Ataur Rahman
Professor
Department of Water Resources Engineering
Bangladesh University of Engineering and Technology

5. ______________________________

AKM Rafiqul Islam
Deputy Director
Department of Environment

6. ______________________________

Dr. Robin Kumar Biswas
Superintending Engineer
Bangladesh Water Development Board

CHAPTER-1

1. GENERAL INFORMATION

1.1. Introduction to MIST

The necessity of establishing a technical institute for the Bangladesh Armed Forces was felt in the late eighties. In the absence of such an institution, officers of Bangladesh Armed Forces had been graduating from Bangladesh University of Engineering and Technology (BUET), Bangladesh Institute of Technology (BIT) and other foreign institutions of science and technology. With a view to meet the increasing demand for the development and dissemination of engineering and technological knowledge, Bangladesh Armed Forces established the Military Institute of Science and Technology (MIST) promised to provide facilities for higher technical education both for the officers of Bangladesh Armed Forces as well as for civil students from home and abroad. The motto of MIST is ―Technology for Advancement. Founded on 19 April 1998, MIST started its journey on 31 January 1999 by offering a four-year bachelor's degree on Civil Engineering. Bachelor degree in Computer Science Engineering course has been started on 2001. Bachelor courses in Electrical, Electronic & Communication Engineering and Mechanical Engineering started its journey from 2003. Bachelor of Science program in Aeronautical Engineering (AE) and Naval Architecture and Marine Engineering (NAME) program were started in 2008-2009 and 2012-2013 respectively. Besides, four new departments started their academic session in 2014-2015 i.e. Nuclear Science & Engineering (NSE), Biomedical Engineering (BME), Architecture (Arch) and Environmental, Water Resources & Coastal Engineering (EWCE).

1.2. Vision and Mission of MIST

1.2.1. Vision

To be a center of excellence for providing quality education in the field of science, engineering and technology and conduct research to meet the national and global challenges.

1.2.2. Mission

a. To provide comprehensive education and conduct research in diverse disciplines of science, engineering, technology and engineering management.
b. To produce technologically advanced intellectual leaders and professionals with high moral and ethical values to meet the socio- economic development of Bangladesh and global needs.
c. To conduct collaborative and research activities with national and international communities for continuous interaction with academia and industry.
d. To provide consultancy, advisory and testing services to government, industrial, educational and other organizations by rendering technical support for widening practical knowledge and to contribute in sustainable socio-economic development.

1.3. Motto and Values of MIST

1.3.1. Motto

As an Institution without gender biasness, MIST is steadily upholding its motto "Technology for Advancement" and remains committed to contributing to the wider spectrum of national educational arena, play a significant role in the development of human resources and gradually pursuing its goal to grow into a 'Centre of Excellence".

1.3.2. Values

a. Integrity and Respect-We embrace honesty, inclusivity, and equity in all that we do.
b. Honesty and Accountability-Our actions reflect our values, and we are accountable for both.
c. Dedication to Quality and Intellectual Rigor-We strive for excellence with energy, commitment and passion.
d. Pursuit of Innovation-We cultivate creativity, adaptability and flexibility in our students, faculties and staffs.

1.4. Eligibility of Students for Admission in MIST

The students must fulfill the following requirements:

a. **Bangladeshi Students.** Minimum qualifications/requirements to take part in the admission test are as follows:
   (1) The applicant must have passed SSC/equivalent examination in Science Group obtaining GPA 4.00 (without fourth subject) in the scale of 5.0 and in HSC/Equivalent examination from Board of Intermediate and Secondary Education/Madrasa Education Board/Technical Education Board in science group the applicant must have obtained minimum 'A+' (Plus) in any TWO (2) subjects out of FIVE (5) subjects including Mathematics, Physics, Chemistry, English, and Bengali and 'A' in rest THREE (3) subjects.
   (2) The applicant must have qualified in minimum five subjects including Mathematics, Physics, Chemistry and English Language with minimum 'B' in average in GCE 'O' Level and in 'A' level he/she must have obtained minimum 'A' in ONE subject out of three subjects including Mathematics, Physics, and Chemistry with and minimum 'B' in rest TWO subjects.
   (3) Applicants who have passed HSC or Equivalent examination in the current year or one year before the notification for admission can apply.
   (4) Sex: Male and Female.

b. **Foreign Students.** Maximum 3% of overall vacancies available will be kept reserved for the foreign students and will be offered to foreign countries through AFD of the Government of the People's Republic of Bangladesh. Applicants must fulfill the following requirements:
   (1) Educational qualifications as applicable for Bangladeshi civil students or equivalent.

(2) Must have security clearance from respective Embassy/High Commission in Bangladesh.
(3) Sex: Male and Female.

In the event of non-availability of foreign students, Bangladeshi civil candidates will fill up the vacancies.

1.5. Number of Seats

The highest number of seats for 04 (Four) years Bachelor Degree in Engineering programs (Unit – A) and 5 (Five) years Bachelor Degree of Architecture programs (Unit – B) are as follows:

Allocation of Seats

Ser	Unit	Department	Seats
1	A	Civil Engineering (CE)	120
2		Computer Science and Engineering (CSE)	120
3		Electrical, Electronic and Communication Engineering (EECE)	120
4		Mechanical Engineering (ME)	120
5		Aeronautical Engineering (AE)	50
6		Naval Architecture and Marine Engineering (NAME)	40
7		Biomedical Engineering (BME)	40
8		Nuclear Science and Engineering (NSE)	40
9		Environmental, Water Resources, and Coastal Engineering	60
10		Industrial and Production Engineering (IPE)	50
11		Petroleum and Mining Engineering (PME)	25
12	B	Architecture (Arch)	25
	Total		**810**

The total number is 810. In general, maximum 50% seats will be allocated to military officers. However, in case of the requirement of military students' vacancy is less in any particular year, the deficient vacancy will be filled up by civil students. MIST also maintains quota as mentioned below:

Ser	Quota Allocation	Seats
1	General Candidates	54%
2	Children of Military Personnel, MOD, MIST	40%
3	Children of Freedom Fighters	2%
4	Tribal Citizen	1%
5	International Students	3%
	Total	**100%**

1.6. Admission Procedure

1.6.1. Syllabus for Admission Test

Admission test will be conducted on the basis of the syllabus of Mathematics, Physics, Chemistry and English (comprehension and functional) subjects of HSC examinations of all boards of secondary and higher secondary school certificates. Admission test will be conducted out of 200 marks and the distribution of marks is given below:

Ser.	Subjects	Marks
a.	Mathematics	90
b.	Physics	70
c.	Chemistry	30
d.	English	10
		Total = 200

1.6.2. Final Selection

Students will be selected on the basis of results of the admission test. Individual choice for selection of departments will be given preference as far as possible. In case of tie in the result of admission test, difference will be judged on the basis of marks obtained in Mathematics, Physics, Chemistry and English respectively in admission test.

1.6.3. Medical Checkup

Civil candidates selected through admission test will go for medical checkup in MIST/CMH. If the medical authority considers any candidate unfit for study in MIST due to critical/contagious/mental diseases as shown in medical policy of MIST will be declared unsuitable for admission.

1.7. <u>Students Withdrawal Policy</u>

1.7.1. For Poor Academic Performance

The under graduate (B.Sc.) Engineering programs for all engineering disciplines are planned for 4 (four) regular levels, comprising of 8 (eight) regular terms. For Architecture program it is planned for 5 (five) regular levels, comprising of 10 (ten) regular terms. It is expected that all students will earn degree by clearing all the offered courses in the stipulated time. In case of failure the following policies will be adopted:

a. Students failing in any course/subject will have to clear/pass the said course/subject by appearing it in supplementary/self-study (for graduating student) examination as per examination policy.
b. Students may also retake the failed subject/course in regular term/short term as per Examination policy.
c. Maximum grading for supplementary/self-study examination etc of failed subjects will be B+ as per examination policy.
d. One student can retake/reappear in a failed subject/course only twice. However, with the Permission of Academic Council of MIST, a student may be allowed for third time as last chance.
e. In case of sickness, which leads to missing of more than 40% class or miss term final examination (supported by requisite medical documents), students may be allowed to withdraw temporarily from that term and repeat the whole level with the regular level in the next academic session, subject to the approval of Academic Council, MIST. However, he/she has to complete the whole undergraduate program within 06 (six)

academic years (for Architecture 07 academic years) from the date of his/her registration.

f. Minimum credit requirement for the award of bachelor's degree in Engineering (B.Sc. Engg) and Architecture (B. Arch) will be decided by the respective Department, approved by the academic council, as per the existing rules. However the minimum CGPA requirement for obtaining a bachelor degree in engineering and Architecture is 2.20.

g. Whatever may be the cases, students have to complete the whole undergraduate Program within 06 (six) academic years (for Architecture 07 academic years) from the date of registration.

h. All other terms and condition of MIST Examination Policy remain valid.

1.7.2. Withdrawal on Disciplinary Ground

a. **Unfair Means.** Adoption of unfair means may result in expulsion of a student from the program and so from the Institution. The Academic Council will authorize such expulsion on the basis of recommendation of the Disciplinary Committee, MIST and as per policy approved by the affiliating university. Following would be considered as unfair means adopted during examinations and other contexts:
    1) Communicating with fellow students for obtaining help in the examination hall.
    2) Copying from another student's script/ report /paper.
    3) Copying from desk or palm of a hand or from other incrimination documents.
    4) Possession of any incriminating document whether used or not.

b. **Influencing Grades.** Academic Council may expel/withdraw any student for approaching directly or indirectly in any form to influence a teacher or MIST authority for enhancing his/her Grades.

c. **Other Indiscipline Behaviors.** Academic Council may withdraw/expel any student on disciplinary ground if any form of indiscipline or unruly behavior is seen in him/her which may disrupt the academic environment/program or is considered detrimental to the image of MIST.

d. **Immediate Action by the Disciplinary Committee of MIST.** The Disciplinary Committee, MIST may take immediate disciplinary action against any student of the Institution. In case of withdrawal/expulsion, the matter will be referred to the Academic Council, MIST for post-facto approval.

1.7.3. Withdrawal on Own Accord

a. **Permanent Withdrawal**

A student who has already completed some courses and has not performed satisfactorily may apply for a withdrawal from the program.

b. **Temporary Withdrawal**

A student, if he/she applies, may be allowed to withdraw temporarily from the program, subject to approval of Academic Council of MIST, but he/she has to complete the whole program within 06 (six) academic years (for Architecture 07 academic years) from the date of his/her registration.

CHAPTER – 2

2. RULES AND REGULATIONS FOR UNDERGRADUATE PROGRAM AT MIST

2.1. Introduction

MIST has introduced course system for undergraduate studies from the academic session 2017-18. The rules and regulations mentioned herein will be applicable to students for administering undergraduate curriculum through the Course System. This will be introduced with an aim of creating a continuous, even and consistent workload throughout the term for the students.

2.2. The Course System

The salient features of the Course System are as follows:

a. Number of theory courses will be generally 5 in each term. However, with the recommendation of course coordinator and Head of the Department, Commandant MIST may allow relaxation in this regard. This relaxation is to be reported to Academic Council of MIST.
b. Students will not face any level repeat for failing.
c. Students will get scope to improve their grading.
d. Introduction of more optional courses to enable the students to select courses according to their individual needs and preferences.
e. Continuous evaluation of students' performance.
f. Promotion of student-teacher interaction and contact.

Beside the professional courses, pertaining to each discipline, the undergraduate curriculum gives a strong emphasis on acquiring thorough knowledge in the basic sciences of mathematics, physics and chemistry. Due importance is also given on the study of several subjects in humanities and social sciences.

The first two years of bachelor's degree programs generally consist of courses on basic engineering, general science and humanities subjects, while the third and subsequent years focus on specific disciplines.

2.3. Number of Terms in a Year

There will be two regular terms – Spring Term (Jan – Jun) and Fall Term (Jul – Dec) in an academic year.

2.4. Duration of Terms

The duration of each regular term will be maximum 22 weeks with the following breakups:

Ser	Events	Durations
1.	Classes before Mid Term	7 weeks
2.	Mid Term Vacation	1 week
3.	Classes after Mid Term	7 weeks
4.	Makeup Classes and Preparatory leave	2/3 weeks
5.	Term Final Examination	2/3 weeks
6.	Term End Vacation	1/2 week

2.5. Course Pattern and Credit Structure

The undergraduate program is covered by a set of theoretical courses along with a set of laboratories (sessional) courses to support them.

2.6. Course Designation System

Each course is designated by a maximum of four-letter code identifying the department offering the course followed by a three-digit number having the following interpretation:

a. The first digit corresponds to the year/level in which the course is normally taken by the students.
b. The second digit is reserved for departmental use. It usually identifies a specific division/area/group of study within the department.
c. The third digit is an odd number for theoretical courses and an even number for sessional courses.
d. The course designation system is illustrated as follows:

EWCE 101 Analytical Mechanics

Course Title

Odd digit designates a theoretical course

Reserved for departmental use (division/group)

Signifies 1^{st} Year/ 1^{st} Level course

Department Identification (EWCE Dept)

EWCE 100 Engineering Drawing and CAD Sessional

Course Title

Even digit designates a sessional course

Reserved for departmental use (division/group)

Signifies 1^{st} Year/ 1^{st} Level course

Department Identification (EWCE Dept)

EECE 167 **<u>Basic Electrical Technology</u>**

Course Title
Odd digit designates a theoretical course
Reserved for departmental use
Signifies 1st Year/ 1st Level course
Department Identification (Electrical, Electronic and Communication Engineering)

CHEM 104 **<u>Chemistry Sessional</u>**

Course Title
Even digit designates a sessional course
Reserved for departmental use
Signifies 1st Year/ 1st Level course
Department Identification (Science and Humanities Department)

2.7. Assignment of Credits

The assignment of credits to a theoretical course follows a different rule from that of a sessional course.

a. Theoretical Courses: One lecture per week per term is equivalent to one credit.
b. Sessional Courses: Credits for sessional courses is half of the class hours per week per term.

Credits are also assigned to project and thesis work taken by the students.

2.8. Types of Courses

The types of courses included in the undergraduate curricula are divided into the following groups:

a. **Core Courses:** In each discipline, a number of courses are identified as core courses, which form the nucleus of the respective bachelor's degree program. A student has to complete the entire designated core courses of his/her discipline.
b. **Prerequisite Courses:** Some of the core courses are identified as prerequisite courses for a specific subject.
c. **Optional Courses:** Apart from the core courses, the students can choose from a set of optional courses. A required number of optional courses from a specified group have to be chosen.

2.9. Course Offering and Instruction

The courses to be offered in a particular term are announced and published in the Course Catalog along with the tentative Term Schedule before the end of the previous term. The courses to be offered in any term will be decided by Board of Undergraduate Studies (BUGS) of the respective department.

Each course is conducted by one or two course teachers who are responsible for maintaining the expected standard of the course and for the assessment of students' performance. Depending on the strength of registered students (i.e. on the number of students) enrolled for the course, the teacher concerned might have course associates and Teaching Assistants (TA) to aid in teaching and assessment.

2.10. Teacher Student Interaction

The new course system encourages students to come in close contact with the teachers. For promotion of a high level of teacher-student interaction, each student is assigned to an adviser and the student is free to discuss all academic matters with his/her adviser. Students are also encouraged to meet any time with other teachers for help and guidance in academic matters. However, students are not allowed to interact with teachers after the moderation of questions.

2.11. Student Adviser

One adviser is normally appointed for a group of students by the BUGS of the concerned department. The adviser advises each student about the courses to be taken in each term by discussing the academic program of that particular term with the student.

However, it is also the student's responsibility to keep regular contact with his/her adviser who will review and eventually approve the student's specific plan of study and monitor subsequent progress of the student.

For a student of second and subsequent terms, the number and nature of courses for which he/she can register is decided on the basis of academic performance during the previous term. The adviser may permit the student to drop one or more courses based on previous academic performance.

2.12. Course Registration

Any student who uses classroom, laboratory facilities or faculty-time is required to register formally. Upon admission to the MIST, students are assigned to advisers. These advisers guide the students in choosing and registering courses.

2.12.1. Registration Procedure

At the commencement of each term, each student has to register for courses in consultation with and under the guidance of his/her adviser. The date, time and venue of registration are announced in advance by the Registrar's Office. Counseling and advising are accomplished at this time. It is absolutely essential that all the students be present for registration at the specified time.

2.12.2. Pre-conditions for Registration

a. For first year students, department-wise enrollment/admission is mandatory prior to registration. At the beginning of the first term, an orientation program will be conducted for them where they are handed over with the registration package on submission of the enrolment slip.
b. Any student, other than the new batch, with outstanding dues to the MIST or a hall of residence is not permitted to register. Each student must clear their dues and obtain a clearance certificate, upon production of which, he/she will be given necessary Course Registration Forms to perform course registration.
c. A student is allowed to register in a particular course subject to the class capacity constraints and satisfaction of pre-requisite courses. However, even if a student fails in a pre-requisite course in any term, the concerned department (BUGS) may allow him/her to register for a course which depends upon the pre-requisite course provided that his/her attendance and performance in the continuous assessment of the mentioned pre-requisite course is found to be satisfactory.

2.12.3. Registration Deadline

Each student must register for the courses to be taken before the commencement of each term. Late registration is permitted only during the first week of classes. Late registration after this date will not be accepted unless the student submits a written application to the registrar through the concerned Head of the department explaining the reasons for delay. Acceptable reasons may be medical problems with supporting documents from the Medical Officer of MIST or some other academic commitments that prohibit enrollment prior to the last date of registration.

2.12.4. Penalty for Late Registration

Students who fail to register during the designated dates for registration are charged a late registration fee of Tk. 100.00 (One hundred only) per credit hours. Penalty for late registration will not be waived.

2.13. Limits on the Credit Hours to be taken

a. A student should be enrolled for at least 15 credit hours and is allowed to take a maximum of 24 credit hours. Relaxation on minimum credit hours may be allowed. A student must enroll for the sessional courses prescribed in a particular term within the allowable credit hour limits.
b. In special cases where it is not possible to allot the minimum required 15 credit hours to a student, the concerned department (BUGS) may permit with the approval of the Commandant, a lesser number of credit hours to suit individual requirements. Such cases are also applicable to students of Level 4 requiring less than 15 credit hours for graduation.

2.14. Course Add/Drop

A student has some limited options to add or drop courses from the registration list. Addition of courses is allowed only within the first two weeks of a regular term and only during the first week of a short term. Dropping a course is permitted within the first four weeks of a regular term. Add/ Drop is not allowed after registration of courses for Supplementary-I and Supplementary-II Examination.

Any student willing to add or drop courses has to fill up a Course Adjustment Form. This also has to be done in consultation with and under the guidance of the student's respective adviser. The original copy of the Course Adjustment Form has to be submitted to the Registrar's Office, where the required numbers of photocopies are made for distribution to the concerned adviser, Head, Dean, Controller of Examinations and the student.

All changes must be approved by the adviser and the Head of the department. The Course Adjustment Form has to be submitted after being signed by the concerned persons.

2.15. Withdrawal from a Term

If a student is unable to complete the Term Final Examination due to serious illness or serious accident, he/she may apply to the Head of the degree awarding department for total withdrawal from the term before commencement of term final examination. However, application may be considered during term final examination in special case. The application must be supported by a medical certificate from the Medical Officer of MIST. The concerned student may opt for retaining the sessional courses of the term. The Academic Council will take the final decision about such applications. However, the total duration for graduation will not exceed 6 academic years.

2.16. 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, class tests, class evaluation, class participation, homework assignment, mid-term exam and a term final examination. The assessments for sessional courses are made by evaluating performance of the student at work during the class, viva-voce during laboratory hours, reports and quizzes. Besides that, at the end there will be a final lab test. Each course has a certain number of credits, which describes its corresponding weightages. A student's performance is measured by the number of credits completed satisfactorily and by the weighted average of the grade points earned. A minimum grade point average (GPA) is essential for satisfactory progress. A minimum number of earned credits also have to be acquired in order to qualify for the degree. Letter grades and corresponding grade points will be given as follows:

Numerical Markings	Grade	Grade Points
80% and above	A+	4.00
75% to below 80%	A	3.75
70% to below 75%	A-	3.50
65% to below 70%	B+	3.25
60% to below 65%	B	3.00
55% to below 60%	B-	2.75
50% to below 55%	C+	2.50

45% to below 50%	C	2.25
40% to below 45%	D	2.00
Below 40%	F*	0.00
Absent	AB	
Dis-collegiate	DC	
Voluntary Withdrawn	VW	
Project/ Thesis continuation	X	-
Expelled	E	-
Satisfactory	S	-

* Subject in which the student gets F grade shall not be regarded as earned credit hours for the calculation of Grade Point Average (GPA).

2.17. <u>Course Assessment Strategy</u>

<u>Theory</u>

Forty percent (40%) of marks of a theoretical course shall be allotted for continuous assessment, i.e. quizzes, home assignments, class tests, observations/ class participation and mid-term examination. These marks must be submitted to the Office of Controller of Examinations before commencement of final exam. The rest of the marks will be allotted to the Term Final Examination. The duration of final examination will be three (03) hours. The scheme of continuous assessment that a particular teacher would follow for a course will be announced on the first day of the classes.

Distribution of marks for a given theory course is as follows:

Class Attendance	5%
Class Performance	5%
Class Test/ Assignment/ Homework	20%
Mid-Term Assessment	10%
Final Examination	60%
Total	**100%**

Note:
Distribution of marks may be changed based on the decision of Academic Council of MIST.

<u>Note:</u>
a. *In final exam, each section can be used for achieving not more than two course outcomes (COs). The remaining Cos should be attained from mid-term assessment or class tests. Course teacher has to inform the student at the beginning of the terms.*

b. *Course teacher of a particular course has to inform the department whether he/she wants to assess mid-term through exam or project within first two weeks of beginning of a term. The duration of mid-term examination should not be more than 50 minutes which has to be* *conducted in between 6th and 9th week of a semester. If mid-term assessment is done through project, then there should be project report and presentation.*

c. *The weightage of class performance can be assessed through checking attentiveness during classes or arranging unnoticed pop quizzes.*

d. *The number of class tests shall be n for 3.0 or above credit courses and (n-1) shall be considered for grading, where n is the number of credits of the course. However, for courses having credits below 3.0, the considered class tests shall be 2 out of 3.*

e. *All class tests will carry 20 marks each. Exam software system will finally convert these achieved marks into total class test marks as per credit hour, i.e. for n=1 (20), n=2 (40), n=3 (60) and n=4 (80) etc.*

f. *Irrespective of the result of the continuous assessment (class performance, class test, mid-term assessment), a student has to appear in the final examination (where applicable) for qualifying/ passing the concerned course/subject.*

Laboratory/Sessional/Practical Examinations

Laboratory/Sessional courses are designed and conducted by the concerned departments. Examination on laboratory/sessional/practical subjects will be conducted by the respective department before the commencement of term final examination. The date of practical examination will be fixed by the respective department. Students will be evaluated in the laboratory/sessional courses on the basis of the followings:

Conduct of Lab Test/ Class Performance	25%
Report Writing/ Programming	15%
Mid-Term Evaluation (exam/project/assignment)	20%
Final Evaluation (exam/project/assignment)	30%
Viva Voce/ Presentation	10%
Total	**100%**

Note: The above distribution of percentage can be rearranged to some extent if required by the department.

Laboratory/Sessional Course in English. The distribution will be as under:

Class Performance/ observation	10%
Written Assignment	15%

Oral Performance	25%
Listening Skill	10%
Group Presentation	30%
Viva Voce	10%
Total	**100%**

2.18. Class Attendance

Class attendance may be considered as a part of continuous assessment. No mark will be allotted for attending classes.

2.19. Criteria for Collegiate, Non-collegiate and Dis-collegiate Students

Students having class attendance of 85% or above in individual subject will be treated as collegiate and less than 85% and up to 70% will be treated as non-collegiate in that subject. The non-collegiate student(s) may be allowed to appear in the examination subject to payment of non-collegiate fee/fine of an amount fixed by MIST/BUP. Students having class attendance below 70% will be treated as dis-collegiate and will not be allowed to appear in the examination and treated as fail. But in a special case such students may be allowed to appear in the examination with the permission of Commandant and it must be approved by the Academic Council.

2.20. Calculation of GPA and CGPA

Grade Point Average (GPA) is the weighted average of the grade points obtained of all the courses passed/completed by a student. For example, if a student passes/completes *n* courses in a term having credits of C_1, C_2, … , C_n and his grade points in these courses are G_1, G_2, … , G_n respectively then

$$GPA=\frac{\sum_{i=1}^{n} CiGi}{\sum_{i=1}^{n} Ci}$$

The Cumulative Grade Point Average (CGPA) is the weighted average of the GPA obtained in all the terms passed/completed by a student. For example, if a student passes/ completes n terms having total credits of TC_1, TC_2, … , TC_n and his GPA in these terms are GPA_1, GPA_2, GPA_n respectively then

$$CGPA=\frac{\sum_{i=1}^{n} TCiGPAi}{\sum_{i=1}^{n} TCi}$$

2.21. Numerical Example

Suppose a student has completed eight courses in a term and obtained the following grades:

Course	Credits, C_i	Grade	Grade G_i	Points, C_i*G_i
EWCE 100	1.50	A-	3.50	5.250
EWCE 101	3.00	A+	4.00	12.000
CHEM 103	3.00	A	3.75	11.250
MATH 101	3.00	B	3.00	9.000
EECE 167	3.00	B-	2.75	8.250
EWCE 131	2.00	B	3.00	6.000
CHEM 102	1.50	A+	4.00	6.000
ME 142	1.50	A	3.75	5.625
Total	**18.50**			**63.375**

GPA = 63.375/18.50 = **3.43**

Suppose a student has completed four terms and obtained the following GPA

Level	Term	Credit Earned, TC_i	Hours GPA Earned, GPA_i	GPA_i*TC_i
1	1	18.50	3.73	69.005
1	2	19.50	3.93	76.635
2	1	21.50	3.96	85.140
2	2	17.50	4.00	70.000
Total		**77.00**		**300.78**

CGPA = 300.78/77.00 = **3.91**

2.22. Minimum Earned Credit and GPA Requirement for Obtaining Degree

Minimum credit hour requirements for the award of bachelor's degree in engineering (B.Sc. Engineering) and other discipline will be decided as per existing rules. The minimum CGPA requirement for obtaining a Bachelor's degree in engineering and other discipline is 2.20.

2.23. Impacts of Grade Earned

The courses in which a student has earned a 'D' or a higher grade will be counted as credits earned by him/her. Any course in which a student has obtained an 'F' grade will not be counted towards his/her earned credits or GPA calculation. However, the 'F' grade will remain permanently on the Grade Sheet and the Transcript.

A student who obtains an 'F' grade in a core course will have to repeat that particular course. However, if a student gets an 'F' in an optional course, he/she may choose to repeat that course or take a substitute course if available. When a student will repeat a course in which he/she has previously obtained an 'F', he/she will not be eligible to get a grade better than 'B+' in that repeated course.

If a student obtains a grade lower than 'B+' in a particular course he/she will be allowed to repeat the course only once for the purpose of grade improvement. However, he/she will not be eligible to get a grade better than 'B+' for an improvement course.

A student will be permitted to repeat for grade improvement purposes a maximum of 6 courses in BSc. Engineering programs and a maximum of 7 courses in B. Arch. Program.

If a student obtains a 'B+' or a better grade in any course he/she will not be allowed to repeat the course for the purpose of grade improvement.

2.24. Classification of Students

At MIST, regular students are classified according to the number of credit hours completed/ earned towards a degree. The following classification applies to all the students:

Level	Credit Hours Earned	
	Engineering	Architecture
Level 1	0.0 to 36.0	0.0 to 34.0
Level 2	More than 36.0 to 72.0	More than 34.0 to 72.0
Level 3	More than 72.0 to 108.0	More than 72.0 to 110.0
Level 4	More than 108.0	More than 110.0 to 147.0
Level 5		More than 147.0

However, before the commencement of each term all students other than new batch are classified into three categories:

a. **Category 1:** This category consists of students who have passed all the courses described for the term. A student belonging to this category will be eligible to register for all courses prescribed for the upcoming term.
b. **Category 2:** This category consists of students who have earned a minimum of 15 credits but do not belong to category 1. A student belonging to this category is advised to take at least one course less since he might have to register for one or more backlog courses as prescribed by his/her adviser.
c. **Category 3:** This category consists of students who have failed to earn the minimum required 15 credits in the previous term. A student belonging to this category is advised to take at least two courses less than a category 1 student subject to the constraint of registering at least 15 credits. However, he will also be required to register for backlog courses as prescribed by the adviser.

Definition of Graduating Student

Graduating students are those students who will have ≤ 24 credit hour remaining for completing the degree requirement.

2.25. Performance Evaluation

The performance of a student will be evaluated in terms of two indices, viz. Term Grade Point Average and Cumulative Grade Point Average which is the grade average for all the terms completed.

Students will be considered to be making normal progress toward a degree if their Cumulative Grade Point Average (CGPA) for all work attempted is 2.20 or higher. Students who regularly maintain a term GPA of 2.20 or better are making good progress toward the degrees and are in good standing with MIST. Students who fail to maintain this minimum rate of progress will not be in good standing. This can happen when any one of the following conditions exists.

a. The term GPA falls below 2.20.
b. The Cumulative Grade Point Average (CGPA) falls below 2.20.
c. The earned number of credits falls below 15 times the number of terms attended.

All such students can make up their deficiencies in GPA and credit requirements by completing courses in the subsequent term(s) and backlog courses, if there are any, with better grades. When the minimum GPA and credit requirements are achieved the student is again returned to good standing.

2.26. 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 Adviser for graduation. Provisional Degree will be awarded by BUP on completion of credit and GPA requirements.

2.27. Time Limits for Completion of Bachelor's Degree

A student must complete his/her studies within a maximum period of six years for engineering and seven years for architecture.

2.28. Attendance, Conduct and Discipline

MIST has strict rules regarding the issues of attendance in class and discipline.

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 as per MIST rules.

Conduct and Discipline

During their stay in MIST all students are required to abide by the existing rules, regulations and code of conduct. Students are strictly forbidden to form or be members of student organization or political party, club, society etc., other than those set up by MIST authority in order to enhance student's physical, intellectual, moral and ethical development. Zero tolerance in regards of sexual abuse and harassment in any forms and drug abuse and addiction are strictly observed in the campus.

2.29. Absence during a Term

A student should not be absent from quizzes, tests, etc. during the term. Such absence will naturally lead to reduction in points/marks, which count towards the final grade. Absence in the Term Final Examination will result in an F grade in the corresponding course. A student who has been absent for short periods, up to a maximum of three weeks due to illness, should approach the course teacher(s) or the course coordinator(s) for make-up quizzes or assignments immediately upon return to classes. Such request has to be supported by medical certificate from competent authority (e.g. CMH/MIST Medical Officer).

2.30. Recognition of Performance

As recognition of performance and ensure continued studies MIST awards medals, scholarships and stipends will be given as per existing rules and practices.

2.31. Types of Different Examination

Following different types of final Examinations will be conducted in MIST to evaluate the students of Undergraduate Programs:

a. **Term Final Examination:** At the end of each normal term (after 22 wk or so), Term Final Examination will be held. Students will appear in the Term Final Examination for all the theory courses they have taken in the Term.

b. **Supplementary Examination:** It will take place twice in a year. Supplementary-I is defined as provision of giving exam in the first week of Spring Term (Jan-Jun)/ Fall Term (Jul – Dec) end break and Supplementary-II in the first week of Fall Term (Jul – Dec)/ Spring Term (Jan – Jun) end break respectively. Students will be allowed to register for a maximum of two theory courses (Failed / Improvement) in Supplementary-I and maximum of one theory course (Failed / Improvement) in

Supplementary-II.

c. **Improvement Examination:** It will be taken during Supplementary-I and Supplementary-II examination. Questions will be same as the question of the regular examination of that Supplementary Examination (if any). Student can take maximum two subjects at a time (two subjects in Supplementary-I and one subject in Supplementary-II) and maximum 6 subjects in the whole academic duration. If a student obtains a grade lower than 'B+' in a course, he/she will be allowed to repeat the course only once for grade improvement. However, he/she will not be eligible to get a grade better then 'B+' for an improvement course. Among the previous result and improvement examination result, best one will be considered as final result for an individual student. However, performance of all examination i,e previous to improvement examination, shall be reflected in the transcript.

2.32. <u>Rules of Different Examinations</u>

<u>Term Final Examination</u>

Following rules to be followed:

i. Registration to be completed before commencement of the class. A student has to register his desired courses paying registration, examination fee and other related fees.
ii. Late registration will be allowed without penalty within first one week of the term.
iii. Within 1st two weeks of a term a student can Add/Drop course/courses. To add a course, in the 3rd week, one has to register the course by paying additional fees. To drop course, one has to apply within three weeks and paid fees will be adjusted/ refunded. If anyone wants to drop a course after three weeks and within 4 weeks, that will be permitted but paid fees will not be refunded in that case.
iv. Registrar office will finalize registration of all courses within 7 (seven) weeks, issue registration slips and that will be followed by issuing Admit Card.
v. Term Final Examination to be conducted in the 18-20th week of the term as per approved Academic Calendar.

<u>Supplementary Examination</u>

Following rules to be followed:

i. Supplementary-I is defined as provision of giving exam in the first week of Spring Term (Jan – Jun) / Fall Term (Jul – Dec) end break and Supplementary-II in the first week of Fall Term (Jul – Dec) / Spring Term (Jan – Jun) end break, respectively.
ii. Students will be allowed to register for a maximum of two theory courses (Failed / Improvement) in Supplementary-I and maximum of one theory course (Failed / Improvement) in Supplementary-II.
iii. No class will be conducted.
iv. 40% marks will be considered from the previous exams.
v. Maximum grading in Supplementary Exam will be 'B+'.
vi. No sessional exam will be conducted.
vii. Examination will be taken on 60% marks like Term Final Examination.
viii. If a student fails in a course more than once in regular terms, then for calculating 40% marks, best one of all continuous assessment marks will be counted.

ix. If anyone fails in the laboratory/sessional course, that course cannot be taken in the supplementary examination.

x. If any student fails in a course, he/she can clear the course retaking it 2nd time, or he/she can clear the examination appearing at the supplementary examination as well. Any one fails twice in a course, can only retake it in the regular term for appearing third time. But anyone fails even after third time, he/she has to take approval of Academic Council of MIST for appearing 4th (last) time in a course and need to pay extra financial penalty. If any student fails even 4th time in a course, will not be allowed to appear anymore in this same course.

xi. Registration of Supplementary-I Exam to be done within 5th wk after completion of Fall Term (July to Dec) and registration of Supplementary-II Exam to be done during the Mid-Term break of Spring Term (Jan –Jun), paying all the required fee.

xii. There will be no provision for add/drop courses after registration.

xiii. Question setting, Moderation and Result Publication to be done following the same rules of Spring (Jan –Jun) / Fall (Jul – Dec) Term Final Exam as per existing MIST Policy.

xiv. Moderation of the questions for Supplementary-I will be done in the 5th week after completion of Fall Term (Jul –Dec) Final Exam and Supplementary-II with the moderation of the questions of Spring Term (Jan – Jun).

xv. Separate Tabulation sheet to be made.

Project and Thesis and Capstone Project

If a student cannot complete project and thesis and Capstone project in two consecutive terms, with the recommendation of the supervisor, he/she may continue for next one/ two term for both within six academic years.

Improvement Examination

Following rules to be followed:

i. Improvement examination is to be taken during the Supplementary-II examinations.

ii. For Improvement examination, registration is to be done during the registration of Supplementary-I and Supplementary-II examinations by paying all the fees.

iii. Question setting, Moderation and Result publication to be done with courses of Supplementary-I and Supplementary-II examinations.

iv. Any student gets a grading below ‘B+’ and desires to improve that course, he/she will be allowed to appear the improvement examination for that particular course.

v. Highest grade of improvement examination will be ‘B+’.

vi. One student is allowed to appear at improvement exam in 6 (six) courses in his/her whole graduation period taking maximum two courses at a time (two courses in Supplementary-I and one course in Supplementary-II).

2.33. Irregular Graduation

If any graduating student clears his/her failed course in Term-1 and his graduation requirements are fulfilled, his graduation will be effective from the result publication date of Term-1 and that student will be allowed to apply for provisional certificate.

3. DEPARTMENT OF ENVIRONMENTAL, WATER RESOURCES, AND COASTAL ENGINEERING (EWCE)

3.1. Introduction to EWCE

In line with the ongoing expansion policy of MIST, Environmental, Water Resources, and Coastal Engineering (EWCE) department is a newly introduced degree awarding department, started its journey from January 2015 session. The department has currently initiated undergraduate degree program and subsequently will go for further enlarging its arena to post graduate degree programs. Concern about environment is a global issue and environmental issues related to large scale civil engineering projects need further special attention in order to minimize the adverse impact on surrounding environment. For Bangladesh managing the vast water resources for its optimum benefit is very vital for overall livelihood of the people. The long stretched coastal zones also offer excellent opportunities to extract maximum output. More so, the unique and dynamic nature of the coastal belt needs special study and extensive research for sustaining any future project along the coastal line. Combining all mentioned above, an all-embracing study and research work on water resources, costal zones and its relevancy on the overall environment is a call for time. Realizing this importance and with a view to contributing in uplifting the socio- economic condition of the country, MIST took the bold step to produce experts on these very specialized fields. It is expected that relevant and all-encompassing studies and researches by this newly introduced department will reduce much of the existing ‘knowledge and understanding gap’ in those fields.

This department is enriched with highly experienced and disciplined teaching staffs having wide vision. This department highly promotes interactive learning and collective class-environment which helps the students become more engrossed in employing themselves with the subject-matter and develop their depth of knowledge in engineering education. In addition, the programs emphasizing on engineering science and design, provides students with ample opportunity to put their knowledge into practice by solving real-world problems under the guidance of our readily approachable faculty members. This department also contributes in the country’s development projects. All-in-all, within a very short span of time, the EWCE department of MIST has spread its outreach throughout the nation and is playing a vital role in building an ingenious society enriched with engineering transcendence and revolution.

The proposed programs from EWCE department comprise a total of 160.0 credit hours and 202.00 contact hours and 08 weeks of field work and internship.

3.2. Major Divisions of the Department

Department of EWCE comprises of following divisions:

1. Division of Environmental Engineering.
2. Division of Water Resources Engineering.

3. Division of Coastal Engineering.

3.3. Vision and Mission of the Department

Vision:

To become a world-class fully fledged school of environmental, water resources and coastal engineering that plays a pivotal role in development sector of any country.

Mission:

a. To produce highly specialized manpower in environmental, water resources, and coastal engineering sectors through teaching, research, innovations, consultancy and partnerships.
b. To produce students with the principles of engineering and the methodology needed for environmental, water resources, and coastal engineering practice.

3.4. Laboratory Facilities of the Department

The department endeavors to provide its faculty members and students adequate laboratory, library and other facilities. Departmental undergraduate courses are laboratory intensive and these requirements are catered by following laboratories:

a. Environmental Engineering Laboratory
b. Estimating & Drawing Shop
c. Survey & Mapping Shop
d. Water Resources Engineering Laboratory
e. Costal Engineering Laboratory
f. GIS Laboratory
g. Structural Mechanics Laboratory
h. Concrete Laboratory
i. Carpentry Shop, Machine Shop and Welding Shop
j. Geotechnical Engineering Laboratory
k. Water and Environmental Model Laboratory

Students have to undertake laboratory courses (sessional) in Physics, Chemistry and English too. If necessary, undergraduate students can access the facilities of other departments and centers during their project, thesis and research works.

3.5. Awarded Degrees from EWCE Department

EWCE department will offer the following degrees in undergraduate program:

a. B.Sc. in Civil and Environmental Engineering
b. B.Sc. in Civil and Water Resources Engineering
c. B.Sc. in Civil and Coastal Engineering

Among the degrees mentioned above, the department is awarding the first two degrees at present and the third one may be awarded in future, if situation demands.

3.6. Revision of Course Curriculum

The first course curriculum of EWCE department was recommended by 25th academic council of BUP and approved by 31st syndicate meeting of BUP in 2014.

Considering the present contexts, job prospects, scopes of academic research on environment/water resources/coastal engineering fields at home and abroad, and types of degree being awarded from different native and foreign universities, the course curriculum of EWCE department was thoroughly revised by the panel of experts from DU, BUET and MIST in 2017 for the second time. The panel of experts agreed to award BSc degree as Civil and Environmental Engineering, Civil and Water Resources Engineering, and accordingly they recommended including almost all core courses of Basic Engineering, Structure, Geotechnical and Transportation Engineering divisions of Civil Engineering Department of BUET and MIST. They also recommended including additional courses (mandatory and optional) on Environment and Water Resources Engineering discipline which might be undertaken in Level 4. Following their recommendations, almost all core courses of CE Department were included in the revised syllabus. The second revision was recommended by 35th academic council meeting of BUP and approved by 42th syndicate meeting of BUP in 2017.

The third revision was recommended by 56th academic council meeting of BUP and approved by 69th syndicate meeting of BUP in 2021. As a part of continuous development of course curriculum, the department has revised the syllabus in 2024 incorporating more contemporary issues in the course contents to make the program more inclined to professional fields of the graduates. The revised course curriculum is presented in Chapter 4 and Chapter 5.

3.7. Program Educational Objectives (PEOs)

The Department of Environmental, Water Resources, and Coastal Engineering (EWCE) forms the foundation for professional and personal development of the graduates that are expected within few years after graduation. The graduates should:

a. Develop strong academic foundation for successful professional career.
b. Acquire skills to excel in the area of civil engineering both in industries and academics.
c. Possess awareness towards higher education, research & development and socio-ethical values.

3.8. Learning Outcomes

Based on the requirements of Board of Accreditation for Engineering and Technical Education (BAETE), Bangladesh, the Bachelor of Science in Civil and Environmental Engineering and Civil and Water Resources Engineering programs will have following learning outcomes:

i. **PO1 Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization (WK1, WK2, WK3, WK4) to the solution of complex Civil engineering problems.
ii. **PO2 Problem analysis**: Able to identify, formulate, research literature and analyze complex Civil engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences (WK1, WK2, WK3, WK4).

iii. **PO3 Design/development of solutions**: Able to design solutions for complex Civil engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal and environmental concerns (WK5).

iv. **PO4 Investigation**: Able to conduct investigations of complex Civil Engineering problems using research-based knowledge (WK8) considering experimental design, data analysis and interpretation of data and information synthesis to provide valid conclusions.

v. **PO5 Modern tool usage**: Able to create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex Civil engineering problems with an understanding of their limitations (WK6).

vi. **PO6 The engineer and society**: Able to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice (WK7).

vii. **PO7 Environment and sustainability**: Able to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development (WK7).

viii. **PO8 Ethics**: Able to apply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice (WK7).

ix. **PO9 Individual work and teamwork**: Able to function effectively as an individual, and as a member or leader of diverse teams and in multi-disciplinary settings.

x. **PO10 Communication**: Able to 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.

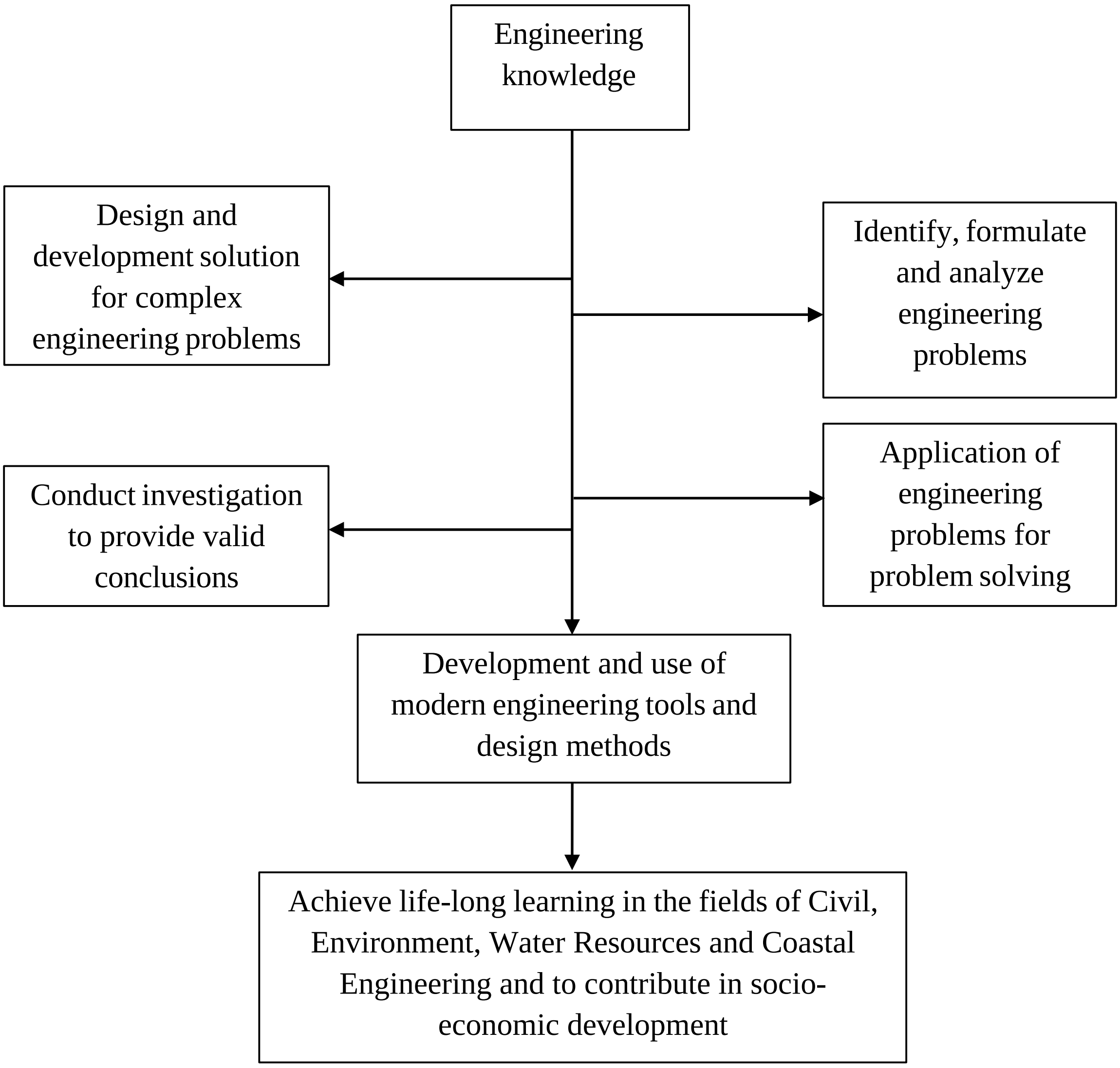
xi. **PO11 Project management and finance**: Able to demonstrate knowledge and understanding of engineering and management principles and apply these to one's work as a team member or a leader to manage projects in multidisciplinary environments.

xii. **PO12 Life-long learning**: Able to recognize the need for, and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

3.9. Generic Skills

a. Apply the principles and theory of civil, environmental, water resources and coastal engineering knowledge to the requirements, design and development of different engineering systems with appropriate understanding.
b. Define and use appropriate research methods and modern tools to conduct a specific project.
c. Learn independently, be self- aware and self- manage their time and workload.
d. Apply critical thinking to solve complex engineering problems
e. Analyze real time problems and justify the appropriate use of technology
f. Work effectively with others and exhibit social responsibility

3.10. Curriculum/ Skill mapping



CHAPTER 4

4. COURSE CURRICULUM STRUCTURE AND SCHEDULE FOR EWCE DEPARTMENT

Considering the program outcome mentioned in Chapter 3, the course schedule for the undergraduate students of the Department of Environmental, Water Resources, and Coastal Engineering (EWCE) is designed and described in this chapter. This curriculum will be effective from spring 2024 session.

4.1. Summary of Course Curriculum (Credit Hours)

Level/ Term	Language	Gen Edu/ Non-skill	Math	Basic Science	Core Programs			Total
					Dept Courses	Other Engg	Technical Electives	
1-I	-	-	3.00	3.00+ 1.50	5.00 +1.50	3.00+ 1.50	-	18.50
1-II	1.50	2.00	3.00	3.00+ 1.50	6.00+1.50	-	-	18.50
2-I	1.50	4.00	3.00	-	9.00+1.50	1.50	-	20.50
2-II	-	2.00	3.00	-	9.00+4.50	-	-	18.50
3-I	-	-	-	-	13.00+4.50	3.00	-	20.50
3-II	-	3.00 + 2.00	-	-	10.00+2.50	3.00 + 1.50	-	22.00
4-I	-	2.00	-	-	12.00+7.00	-	-	21.00
4-II	-	-	-	-	3.00+4.50	-	10.00+3.00	20.50
Total Credit Hrs	3.00	18.00	12.00	9.00	94.50	10.50	13.00	160.0
% Of Total Course	1.88%	11.25%	7.5%	5.63%	59.06%	6.56%	8.12%	100%

4.2. Summary of Term wise Theory and Laboratory Courses

Sl	Level	Term	No. Theory Courses	Theory (Cr. Hr)	No. Lab Courses	Lab (Cr. Hr)	SIP (Cr. Hr)	Thesis and Capstone Project (Cr. Hr)	Credit
1	1st	I	5	14	3	4.5	-	-	18.50
2		II	5	14	3	4.5	-	-	18.50
3	2nd	I	6	16	3	4.5	-	-	20.50
4		II	5	14	4	4.5	-	-	18.50
5	3rd	I	5	16	3	4.5	-	-	20.50
6		II	5	17	2	4.0	1.0	-	22.00
7	4th	I	5	14	3	4.5	-	2.5	21.00
8		II	5	13	2	3	-	4.5	20.50
Total									160.00

4.3. Contact Hours and Credit Hours' Distribution in Eight Terms

Level/Term	Theory Contact Hours	Sessional Contact Hours	Theory Credit Hours	Sessional Credit Hours	Total Contact Hours	Total Credit Hours
1/I	14.00	9.00	14.00	4.50	23.00	18.50
1/II	14.00	9.00	14.00	4.50	23.00	18.50
2/I	16.00	9.00	16.00	4.50	25.00	20.50
2/II	14.00	9.00	14.00	4.50	23.00	18.50
3/I	16.00	9.00	16.00	4.50	25.00	20.50
3/II	17.00	10.00	17.00	5.00	27.00	22.00
4/I	14.00	14.00	14.00	7.00	28.00	21.00
4/II	13.00	15.00	13.00	7.50	28.00	20.50
Total	**118.00**	**84.00**	**118.00**	**42.00**	**202.00**	**160.00**

4.4. Thesis and Capstone Project

Thesis and Capstone Project will have to be undertaken by students under a supervisor in partial fulfillment of the requirement of his/her degree in the final year/ Level 4. Credit hours allotted to the thesis will be 4.00 and Capstone Project will be 3.00 corresponding to 14.00 contact hours.

4.5. Teaching Strategy

a. Theory courses will be conducted by participatory lectures, presentation slides, demonstration videos, white board etc.
b. Sessional courses will be conducted by lab demonstration, test, field sampling, field visit etc. based on the course contents

4.6. Block Syllabus Effective from Spring 2024 Session and onwards (for Batch EWCE -10 and onwards)

Total credit hours: 160.0

LEVEL-1, TERM-I

Course No	Course Name	Type of Course	Credit Hour	Contact Hour
CHEM 103	Fundamentals of Chemistry	Theory	3.0	3.0
MATH 101	Differential and Integral Calculus		3.0	3.0
EECE 167	Basic Electrical Technology		3.0	3.0
EWCE 101	Analytical Mechanics		3.0	3.0
EWCE 131	Environment, Ecology and Water Resources		2.0	2.0
	Subtotal (Theory)		**14.00**	**14.00**
CHEM 104	Chemistry Sessional	Sessional	1.5	3.0
ME 142	Workshop Sessional		1.5	3.0
EWCE 100	Engineering Drawing and Computer Aided Design Sessional		1.5	3.0
	Subtotal (Sessional)		**4.5**	**9.0**
	Total = Credits: 18.50 Contact hours: 23.00			

LEVEL-1, TERM- II

Course No	Course Name	Type of Course	Credit Hour	Contact Hour
PHY 129	Waves and Oscillations, Optics and Structure of Matter	Theory	3.0	3.0
MATH 103	Differential Equations and Matrix		3.0	3.0
GEBS 101	Bangladesh Studies		2.0	2.0
EWCE 103	Surveying		3.0	3.0
EWCE 105	Environmental Chemistry		3.0	3.0
	Subtotal (Theory)		**14.00**	**14.00**
PHY 130	Physics Sessional	Sessional	1.5	3.0
LANG 102	Communicative English-1		1.5	3.0
EWCE 104	Practical Surveying	Field Work	1.5	3.0*
	Subtotal (Sessional & Field Work)		**4.5**	**9.0**
	Total = Credits: 18.50, Contact hours: 23.00			

* Equivalent Contact Hours [Duration - 4 Weeks, after Term Final Examination].

LEVEL-2, TERM-I

Course No	Course Name	Type of Course	Credit Hour	Contact Hour
GELM 275	Leadership and Management	Theory	2.0	2.0
MATH 201	Vector Analysis, Laplace Transform & Co-ordinate Geometry		3.0	3.0
EWCE 201	Construction Materials		3.0	3.0
GES 201	Fundamentals of Sociology		2.0	2.0
EWCE 205	Numerical Methods		2.0	2.0
EWCE 211	Mechanics of Solids		4.0	4.0
	Subtotal (Theory)		**16.00**	**16.00**
CSE 278	Computer Programming and Computations Sessional	Sessional	1.5	3.0
LANG 202	Communicative English-II		1.5	3.0
EWCE 212	Structural Mechanics and Materials Sessional		1.5	3.0
	Subtotal (Sessional)		**4.5**	**9.0**
	Total = Credits: 20.50, Contact hours: 25.00			

LEVEL-2, TERM-II

Course No	Course Name	Type of Course	Credit Hour	Contact Hour
GEA 201/ GEE 201	Principles of Accounting/ Fundamentals of Economics	Theory	2.0	2.0
MATH 203	Applied Math for Engineering		3.0	3.0
EWCE 203	Geology and Geomorphology		3.0	3.0
EWCE 261	Fluid Mechanics		3.0	3.0
EWCE 213	Structural Analysis I		3.0	3.0
	Subtotal (Theory)		**14.00**	**14.00**
EWCE 200	Details of Construction & Quantity Surveying	Sessional	1.5	3.0
EWCE 206	GIS in Environmental and Water Resources Engineering		1.5	3.0
EWCE 262	Fluid Mechanics Sessional		1.5	3.0
	Subtotal (Sessional)		**4.5**	**9.0**
	Total = Credits: 18.50, Contact hours: 23.00			

LEVEL-3, TERM-I

Course No	Course Name	Type of Course	Credit Hour	Contact Hour
EWCE 363	Engineering Hydrology	Theory	3.0	3.0
CE 385	Design of Concrete Structures I		3.0	3.0
EWCE 331	Water Supply Engineering		3.0	3.0
EWCE 341	Geotechnical Engineering- I: Principle and Practices of Soil Mechanics		3.0	3.0
EWCE 351	Transportation Engineering		4.0	4.0
	Subtotal (Theory)		**16.00**	**16.00**
EWCE 332	Environment Engineering Sessional	Sessional	1.5	3.0
EWCE 342	Geotechnical Engineering Sessional		1.5	3.0
EWCE 352	Transportation Engineering Sessional		1.5	3.0
	Subtotal (Sessional)		**4.5**	**9.0**
	Total = Credits: 20.50, Contact hours: 25.00			

LEVEL-3, TERM-II

Course No	Course Name	Type of Course	Credit Hour	Contact Hour
GEPM 375	Project Planning and Construction Management	Theory	3.0	3.0
CE 387	Design of Concrete Structure II		4.0	4.0
EWCE 333	Waste Water Engineering and Sanitation		4.0	4.0
EWCE 343	Geotechnical Engineering- II: Foundation Engineering		3.0	3.0
EWCE 361	Open Channel Hydraulics		3.0	3.0
	Subtotal (Theory)		**17.00**	**17.00**
EWCE 300	Students' Internship Program (SIP)	Internship	1.0	2.0[+]
CE 386	Concrete Structure Design Sessional I	Sessional	1.5	3.0
EWCE 362	Open Channel Hydraulics Sessional		1.5	3.0
GERM 352	Fundamentals of Research Methodology		1.0	2.0
	Subtotal (Internship & Sessional)		**5.0**	**10.0**
	Total = Credits: 22.0, Contact hours: 27.00			

[+] Equivalent Contact Hours [Duration – 4 Weeks, after Term Final Examination].

LEVEL-4, TERM-I

Course No	Course Name	Type of Course	Credit Hour	Contact Hour
GEEM 445	Engineering Ethics and Professional Practices	Theory	2.0	2.0
EWCE 411	Structural Analysis II		3.0	3.0
EWCE 431	Environment and Social Impact Assessment		3.0	3.0
EWCE 461	River Engineering and Flood Management		3.0	3.0
EWCE 471	Coastal Engineering		3.0	3.0
	Subtotal (Theory)		**14.00**	**14.00**
EWCE 432	Environmental Engineering Design Sessional	Sessional	1.5	3.0
EWCE 462	Computer Applications in Water and Environmental Engineering		1.5	3.0
EWCE 464	Advanced Applications of GIS and RS		1.5	3.0
EWCE 400	Project and Thesis	Research	1.0	2.0
EWCE 402	Capstone Project	Design Project	1.5	3.0
	Subtotal (Sessional & Project)		**7.0**	**14.0**
	Total = Credits: 21.0; Contact hours: 28.00			

LEVEL-4, TERM-II (Major: Environmental Engineering)

Course No	Course Name	Type of Course	Credit Hour	Contact Hour
EWCE 467	Integrated Water Resource Management (IWRM)	Compulsory Theory	3.0	3.0
EWCE 433	Solid and Hazardous Waste Management	Major Theory	3.0	3.0
EWCE 435	Air Pollution and Control		2.0	2.0
EWCE 437	Industrial Waste and Waste Water Treatment		3.0	3.0
EWCE 469/ 473/ 475/ 477/ 479	Mathematical Modelling in Water Resources Engineering/ Waterway Engineering/ Urban Hydrology/Climatology/Groundwater Engineering	Minor Theory	2.0	2.0
	Subtotal (Theory)		**13.00**	**13.00**
EWCE 400	Project and Thesis	Research	3.0	6.0
EWCE 402	Capstone Project	Design Project	1.5	3.0
EWCE 434	Environmental Modelling Sessional	Sessional	1.5	3.0
EWCE 436/ 438	Treatment Plant Design Sessional/ Building Service Sessional		1.5	3.0
	Subtotal (Sessional & Project)		**7.5**	**15.00**
	Total = Credits: 20.50, Contact hours: 28.00			

LEVEL-4, TERM-II (Major: Water Resources Engineering)

Course No	Course Name	Type of Course	Credit Hour	Contact Hour
EWCE 467	Integrated Water Resource Management (IWRM)	Compulsory Theory	3.0	3.0
EWCE 463	Irrigation and Drainage Engineering	Major Theory	3.0	3.0
EWCE 465	Design of Hydraulic Structures		3.0	3.0
EWCE 477/ 479	Climatology / Groundwater Engineering		2.0	2.0
EWCE 435/ 439/481/ 483/485	Air Pollution and Control / Natural Resources & Renewable Energy/ Climate Change & Disaster Management/ Building Services/ Environmental Management System	Minor Theory	2.0	2.0
	Subtotal (Theory)		**13.00**	**13.00**
EWCE 400	Project and Thesis	Research	3.0	6.0
EWCE 402	Capstone Project	Design Project	1.5	3.0
EWCE 466	Hydraulic Structure Design Sessional	Sessional	1.5	3.0
EWCE 468	Water Modelling Sessional		1.5	3.0
	Subtotal (Sessional & Project)		**7.5**	**15.00**
	Total = Credits: 20.50, Contact hours: 28.00			

CHAPTER 5

5. DETAILED CURRICULUM OF UNDERGRADUATE COURSE

5.1. Courses Offered by EWCE Department

COURSE INFORMATION	
Course Code: EWCE 100	Credit Hour: 1.5
Course Title: Engineering Drawing and Computer Aided Design Sessional	Contact Hour: 3.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
It will be useful for designing and drawing schematics for simple blocks, orthographic and isometric representations, dimensioning, etc. Designing and drawing of basic civil engineering components using AutoCAD will be helpful during project work in later semesters, as well as professionally. In this course students will be able to learn how to draw the plan, elevation and sectional view of one storied building both on paper and using AutoCAD as well as bridges, culvert, embankments.	
OBJECTIVE	
1. To get familiar with different drawing instruments and technical standards. 2. To develop a deep understanding of different geometric figures and orthographic views. 3. To understand the concept of plan, elevation and sectional views of one storied building. 4. To gain knowledge about the basic functions of AutoCAD efficiently. 5. To take data and transform it into graphic drawings.	
COURSE CONTENT	
Lines and lettering, plane geometry: drawing of linear and curved geometric figures, e.g., pentagon, hexagon, octagon, ellipse, solid geometry: concept of isometric view and oblique view, theory of projections, drawing of isometric view of 3D objects, projections of cube, prism, developments of cube; plan, elevations, and sectional views of one storied building. Introduction to computer usage, introduction to CAD packages and computer aided drafting: drawing editing and dimensioning of simple objects, plan, elevations and sectional views of one-storied buildings, plans, elevations and sections of culverts, embankments, and other hydraulic and coastal structures.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Ability to **recognize** various drawing instruments and understand basic techniques of drawing	√											
2	CO2: Ability to **understand** 2D and 3D views of different objects, shaped, buildings and hydraulic structures	√											
3	CO3: Ability to **draw** different views of structural elements.	√											
4	CO4: Ability to **understand** the					√							

	basic concept and features of AutoCAD software in engineering applications												
5	CO5: Ability to **apply** the knowledge to draw detail architectural and structural drawing of buildings, embankments, and culverts.	√											
6	CO6: Ability to **apply** the knowledge to draw sectional view, plan view and elevation of various structures	√											

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to **recognize** various drawing instruments and understand basic techniques of drawing	1	C2	1	–	3	Class Assessment, Assignment, Mid quiz
CO2	Ability to **understand** 2D and 3D views of different objects, shaped, buildings and hydraulic structures	1	C2	1	–	3	Class Assessment, Assignment, Mid quiz
CO3	Ability to **draw** different views of structural elements.	1	C3	1	–	3, 5	Class Assessment, Assignment, Mid quiz
CO4	Ability to **understand** the basic concept and features of AutoCAD software in engineering applications	5	C5	1	–	3, 6	Class Assessment, Assignment, Final quiz
CO5	Ability to **apply** the knowledge to draw detail architectural and structural drawing of buildings, embankments, and culverts.	1	C3	1	–	3, 5	Class Assessment, Assignment, Final quiz
CO6	Ability to **apply** the knowledge to draw sectional view, plan view and elevation of various structures	1	C3	1	–	3, 5	Class Assessment, Assignment, Final quiz

	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember, C2 – Understand, C3- Apply, C4 – Analyze, C5 - Evaluate, C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture (3 hours/week × 12 weeks)	36
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	2 4 4
Formal Assessment • Continuous Assessment • Quiz	12 2
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	1	Introduction and Use of Instruments; Lettering / Numbering / Lines / Dimensioning	Class Assessment, Home Assignment, Mid Quiz
2	2	Plane Geometry: Pentagon, Hexagon, Octagon, Plane Geometry: Ellipse, Parabola, Hyperbola	
3	3	Isometric View of 3D Objects Sectional View of 3D Objects	
4	4	Orthographic View of 3D Objects Sectional View of 3D Objects	
5	5	Introduction to Different Parts of a Building; Plan and Elevation of One Storied Building	
6	6	Sectional views of One Storied Building	
7		Mid Quiz	
8	7	Introduction to AutoCAD and its features	Class Assessment, Home Assignment, Final Quiz
9	8	Object snap, text writing, hatching, making blocks, dimensioning, object properties, plotting	
10	9	One-storied building: foundation, plan, elevation, sectional view, detailing	
11	10	One-storied building: foundation, plan, elevation, sectional view, detailing (continued)	
12	11	Introduction to coastal structures, regulator, aqueduct	
13	12	Top view, front elevation, and cross section of an embankment	
14		Final Quiz	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**

Continuous Assessment (Class assessments / Assignments / Active Class Participation)	40%	CO1, CO2, CO3, CO4, CO5, CO6	C2, C3, C5
Quiz	60%	CO1, CO2, CO3, CO4, CO5, CO6	C2, C3, C5
Total Marks	100%		

REFERENCE BOOKS

1. Civil Engineering Drawing by - Gurcharan Singh & Subash Chandra
2. Prathomic Engineering Drawing by - Hamonto Kumar Bhottacharjo
3. Engineering Drawing by Basant Agrawal and C M Agrawal

COURSE INFORMATION	
Course Code: EWCE 101	Credit Hour: 3.0
Course Title: Analytical Mechanics	Contact Hour: 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

Purpose of this course is to provide students the basic concept and in-depth knowledge in the field of mechanics of rigid body which will be helpful for their future study/ courses

OBJECTIVE

1. Understanding different force systems and their basic mathematics to solve statically determinate stationary rigid bodies, external / internal forces in a statically determinate beam, trusses and frames composed of pin connected members and forces developed in the cables and supports.
2. To apprehend the problems involving friction and their real application (in a limited scale).
3. To determine geometric properties like centroids of line, area and volume, Theorems of Pappus and Guldinus, Centre of pressure along with internal properties of object such as Rectangular and Polar Moment of Inertia and Radius of gyration of single and composite areas, Transfer formula, Product of Inertia, Moment of Inertia at inclined axis, maximum and minimum moment of inertia, Moment of Inertia of Masses.
4. Solve different problems with the concept of linear Impulse and Momentum.

COURSE CONTENT

Coplanar and non-coplanar force systems, concepts of free body diagram, equations for static equilibrium, internal forces and moments, analyses of two-dimensional frames and trusses, friction, impending moment, introduction to space frames, centroids of lines, areas and volumes, moments of inertia of areas and masses, liner momentum and impulse.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Ability to **understand** free body diagrams of different types of rigid bodies.	√											
2	CO2: Ability to **apply** equations of equilibrium to analyze statically determinate rigid bodies		√										
3	CO3: Ability to **estimate** the geometric properties like centroids,	√											

	moment of inertia etc. of different objects.												
4	CO4: Ability to **apply** the principles of impulse and momentum.		√										

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	CO1: Ability to **understand** free body diagrams of different types of rigid bodies	1	C2	1	–	1	Pop Quiz, Final Exam
CO2	CO2: Ability to **apply** equations of equilibrium to analyze statically determinate rigid bodies	2	C3	1	–	1	Class Test, Mid-Term, Final Exam
CO3	CO3: Ability to **estimate** the geometric properties like centroids, moment of inertia etc. of different objects.	1	C3	1	–	1	Mid Term, Final Exam
CO4	CO4: Ability to **apply** the principles of impulse and momentum.	2	C3	1	–	1	Class Test, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom’s Taxonomy: C1 – Remember, C2 – Understand, C3- Apply, C4 – Analyze, C5 - Evaluate, C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Self- Directed Learning ● Non-face-to-face learning ● Revision of the previous lecture at home ● Preparation for final examination	 09 18 46
Formal Assessment ● Continuous Assessment ● Final Examination	 02 03
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	1	Resultant and Components of Forces	CT/ Assignment/ Final Exam
	2	Types of Forces and Introduction to Coplanar Concurrent Forces	
	3	Centroids: Definitions of centroids, centre of mass and centre of gravity, Formulas of centroids for line, area and volume.	
2	4	Concept of Equilibrium	
	5	Free Body Diagrams	
	6	Principle of symmetry and centroid, centroid by summation method	
3	7	Introduction to Truss	
	8	Analysis of Truss by joint Method	
	9	Centroid by Integration, practice centroid of lines by integration	
4	10	Analysis of Truss by Joint to Joint Method	CT/ Assignment/ Final Exam
	11	Tutorial 1(on Forces, Resultant and Components)	
	12	Centroid of Arc of a Circle, Centroid of plane triangle, Centroid of sector of a circle, Centroid of area without axis of symmetry.	
5	13	Tutorial on Analysis of Truss/Frames	
	14	Concept of Moments	
	15	Centroid of a volume (right circle cone, cylinder, hemisphere etc.)	
6	16	Concept of Parallel Force System	Mid Term/ Assignment/ Final Exam
	17	Determination of Reaction Forces, Forces on Members of Frames	
	18	Centroid of composite area, Centroid of composite volume	
7	19	Tutorial on Determination of Reaction Forces, Forces on Members of Frames	
	20	Tutorial on Determination of Reaction Forces, Forces on Members of Frames	
	21	Theorem of Pappus and Guldinus, Center of Pressure	
8	22	Non-Concurrent, non–Parallel, Coplanar Forces	
	23	Analysis of Truss by Method of Section	
	24	Practice problem related to Theorem of Pappus and Guldinus, Center of Pressure	
9	25	Concept of Rectangular and Polar moment of Area and radius of gyration, Parallel axis, and perpendicular axis theorem (Transfer formula, rectangular to polar)	
	26	Tutorial on Analysis of Truss by Method of Section	
	27	Practice problems of Rectangular Moment of Inertia and radius of gyration with axis of symmetry (Rectangle, triangle etc)	
10	28	Tutorial on non-concurrent, non – Parallel, Coplanar Forces	
	29	Practice problems of Rectangular Moment of Inertia and radius of gyration with axis of symmetry (Rectangle, triangle etc)	
	30	Maximum and Minimum Moment of Inertia by	

		formula and Mohr's circle	
11	31	Formula and practice problems (solid cylinder) for Moment of Inertia of Masses and radius of Gyration.	
	32	Concept of Friction and Belt Friction	
	33	Moment of Inertia about Inclined Axis, Product of Inertia	
12	34	Analysis of Wedges	CT/ Assignment/ Final Exam
	35	Tutorial on problems associated with Friction	
	36	Moment of Inertia of Composite areas	
13	37	Tutorial on Friction and Belt Friction	
	38	Moment of inertia of mass and practice problems (Sphere, thin disk, cone) I	
	39	Moment of inertia of mass and practice problems (Sphere, thin disk, cone) II	
14	40	Problem solving on Wedges	
	41	Moment of Inertia of masses of composite bodies	
	42	Problems solving on impulse and momentum	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C3
Final Exam	60%	CO2, CO3	C3
Total Marks	100%		

REFERENCE BOOKS

1. "Analytic Mechanics" by – Faires & Chambers (3rd Edition).
2. "Engineering Mechanics" by – Singer.
3. "Engineering Mechanics: Statics", 13th Ed., Hibbeler.
4. "Engineering Mechanics: Dynamics", 13th Ed., Hibbeler.
5. "Fundamentals of Physics:, 9th Ed., Halliday, Resnick and Walker.

COURSE INFORMATION

Course Code: EWCE 103	Credit Hour: 3.0
Course Title: Surveying	Contact Hour: 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

The purpose of this course is to familiar with, to use various types of surveying technologies, procedures and provide basic knowledge on different kinds of surveying in the professional fields which will be helpful during project work in later stages as well as professionally.

OBJECTIVE

1. To become technically adept on surveying technologies as well as procedures of different types of surveying in their professional fields.
2. To enable the graduates in assisting professional land surveyors in various surveying

and mapping projects.

3. To facilitate the graduates to perform their works, duties with a commitment to quality, timeliness, and continuous improvement in surveying in their respective carriers. .

COURSE CONTENT

Fundamentals of surveying, linear measurement, chain surveying, plane table survey, traverse surveying, leveling, calculation of area and volume, topographic survey, trigonometrical survey, tachometric surveying, curves and curve setting, project survey. Special and modern survey equipment (Total station, EDM, RTK-GPS, ADCP, Echosounder, OBS etc.). Hydrographic survey (velocity profile, measurement of velocity and discharge, sounding, tide gages), photogrammetry, astronomical surveying, GIS, GPS, RS (remote sensing), drone survey.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Able to understand basic survey techniques and procedures as well as use of survey equipment/instruments	√											
2	CO2: Able to use different topographic survey methods i.e. leveling, traversing, tachometry etc.		√										
3	CO3: Able to apply the concept of curve setting and route survey i.e. contouring, calculation of area and volume in civil engineering application.		√										
4	CO4: Able to understand the basic concept of map, hydrographic and astronomical survey, and drone survey, GIS, GPS and RS (remote sensing).	√											

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to understand basic survey techniques and procedures as well as use of survey equipment/instruments	1	C1, C2	-	1,3	1	Class Test, Final Exam
CO2	Able to use different topographic survey methods i.e. leveling, traversing, tachometry etc.	2	C3, C5	-	1	1, 6	Class Test, Mid-term, Final Exam
CO3	Able to apply the concept of curve setting and route survey i.e. contouring, calculation of area and volume in civil engineering application.	2	C4, C5	-	1	1, 6	Assignment, Class Test, Final Exam
CO4	Able to understand the basic concept of map, hydrographic and astronomical survey, and drone survey, GIS, GPS and RS (remote sensing).	1	C2, C3	-	1	1, 3	Assignment, Class Test, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom’s Taxonomy:						

	C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create
	(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)					

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Guided Learning Tutorial/ Assignments (2 hours/week × 6 weeks)	12
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	 11 18 32
Formal Assessment a) Continuous Assessment b) Final Examination	 2 3
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction to surveying, definition. Classification. Importance of Surveying	
	02	Useful Data and Formulae. Calculation of Areas	
	03	Useful Data and Formulae. Calculation of Volumes	
2	04	Chain Surveying, Definition. Procedure. Errors in Chaining. Plotting of Details	CT1
	05	Advantages and disadvantages of Chain Survey. Linear Measurements	
	06	Traverse Surveying, Definition. Prismatic Compass. Surveyor's Compass	
3	07	Useful Definitions, Bearings. Local Attraction.	
	08	Useful Definitions, Field Procedure, Plotting of Compass Traverse	
	09	Closing Error and its Adjustment. Characteristics of Closed Traverses. Traverse Chart. Open Traverse	
4	10	Plane Table Surveying, Definition. Instruments. Procedure. Orientation.	Mid Term Exam
	11	Methods of Plane Tabling, Radiation. Intersection. Traversing. Resection	
	12	Levels and Levelling Definition. Dumpy Levels. Wye Levels. Levelling Staff Adjustment of Levels I	
5	13	Levels and Levelling Definition. Dumpy Levels. Wye Levels. Levelling Staff Adjustment of Levels II	
	14	Definitions of Various Terms. Purpose of Leveling. Procedure of Levelling Operation	
	15	Methods of Calculating Levels. Effect of Curvature and Refraction on Levelling. Errors in Levelling. Accuracy Required in Levelling Operation I	

6	16	Methods of Calculating Levels. Effect of Curvature and Refraction on Levelling. Errors in Levelling. Accuracy Required in Levelling Operation II	
	17	Tacheometry or Stadia Surveying,	
	18	Definition- Instruments. Theory. Tacheometric Constants	
7	19	Anallatic lens, field procedure, errors and accuracy I	
	20	Anallatic lens, field procedure, errors and accuracy II	
	21	Curves and Curve Ranging, Definition Notations for Circular Curves	CT 2
8	22	Elements of Circular Curve	
	23	Methods of Ranging Curves. Transition Curves	
	24	Vertical Curves	
9	25	Astronomical Surveying, Definitions	
	26	Systems of Coordinates of Heavenly Bodies	
	27	Astronomical Corrections. Instruments. Time. Equation of Time I	
10	28	Astronomical Corrections. Instruments. Time. Equation of Time II	
	29	Azimuth and Bearing of a Survey Line: True Meridian. Latitude. Longitude	
	30	Photogrammetry, Definition. Classification	
11	31	Terrestrial Photogrammety. Photo-Theodolite. Works in Terrestrial Photogrammetry I	
	32	Terrestrial Photogrammety. Photo-Theodolite. Works in Terrestrial Photogrammetry II	
	33	Plotting Stereophcrogrammetry. Parallax I	
12	34	Plotting Stereophcrogrammetry. Parallax II	CT 3
	35	Aerial Photogrammetry. Scale of Photographs. Compilation and Mapping I	
	36	Aerial Photogrammetry. Scale of Photographs. Compilation and Mapping II	
13	37	Hydrographic Surveying, Definition. Soundings. Velocity Profile	
	38	Methods of locating Soundings. Plotting of Soundings. The tides. Discharge measurement I	
	39	Methods of locating Soundings. Plotting of Soundings. The tides. Discharge measurement II	
14	40	GIS and Remote Sensing techniques I	
	41	GIS and Remote Sensing techniques II	
	42	Review of Surveying Course	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2. CO3, CO4	C1, C2, C3, C4, C5
Final Exam	60%	CO1, CO2. CO3, CO4	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. Surveying - Volume I, II, III - Dr. B.C. Punmia (SI Units)
2. A Text book of Surveying - M.A. Aziz & Shahjahan

3. Schaum's Outline of Introductory Surveying - Roy Wirshing and James Wirshing
4. Construction Surveying and Layout: A Step-By-Step Field Engineering Methods - Wesley G. Crawford
5. Basic Surveying - Raymond Paul and Walter Whyte, 4th Ed.

COURSE INFORMATION	
Course Code: EWCE 104	Credit Hour: 1.5
Course Title: Practical Surveying	Contact Hour: 3.0

PRE-REQUISITE

EWCE 103 (Surveying)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

The purpose of this course is to introduce various instruments of surveying and applying those in the field. This training will be useful for the students in professional field.

OBJECTIVE

1. To orient the students with the use of various instruments of surveying and applying those in the field of survey.
2. To utilize the students 'theoretical knowledge on surveying (EWCE-103) into practical fields.
3. To train the students to plan and execute survey work for any engineering project.

COURSE CONTENT

Linear and angular measurement techniques, traverse surveying, leveling and contouring, curve setting, tachometry, project surveying, modern surveying equipment and their applications, hydrographic surveying.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Able to use appropriate survey instruments i.e. chain, plane table, level, theodolite, total station etc. in survey field works	√											
2	CO2: Able to analyze survey data in preparing longitudinal and transverse profiles of a route and contour map of an area.		√										
3	CO3: Able to work effectively as an individual and as a member of a team in survey field works									√			

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods

CO1	Able to **use** appropriate survey instruments i.e. chain, plane table, level, theodolite, total station etc. in survey field works	1	C3	1,2		6	Daily Quiz, Report, Final Quiz, Viva
CO2	Able to **analyze** survey data in preparing longitudinal and transverse profiles of a route and contour map of an area	2	C4	2,3		5,6	Daily Quiz, Report, Final Quiz, Viva
CO3	Able to **work** effectively as an individual and also as a member of a team in survey field works	9	C3	1		6	Daily Quiz, Report, Final Quiz, Viva
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA=Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture (2hours/week × 3 weeks) • Field work (15 hours/week × 3 weeks)	 6 45
Self- Directed Learning • Report preparation (2hours/week × 3 weeks) • Preparation for quiz and viva	 6 2
Formal Assessment Quiz and viva	 1
Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Linear and angular measurement techniques	Daily Quiz, Report, Final Quiz, Viva
	02	Route survey; Calculation of cut and fill volume	
	03	Traverse surveying	
	04	Trigonometric surveying	
	05	Tacheometric surveying	
2	06	Contouring	
	07	Curve setting: Simple Circular Curve	
	08	Curve setting: Combined Curve	

	09	Plane Table Survey	
	10	Project surveying	
3	11	Hydrographic survey	
	12	Application of modern surveying equipment's like GPS, Total station, RTK GPS etc.	
	13	Application of modern surveying equipment's like GPS, Total station, RTK GPS etc.	
	14	Final Quiz	
	15	Field Test and Viva	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Daily Quiz, Field performance/ works /attendance, Observations, Final reports and assignments, Practical exam)	85%	CO1, CO2, CO3	C3, C4
Final Exam	15%	CO1, CO2, CO3	C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. 1. Surveying- Volume I, II, III - Dr. B.C. Punmia (SI Units).
2. A Text book of Surveying - M.A. Aziz & Shahjahan.
3. Practical Surveyor - Samuel Wyld and David Manthey.

COURSE INFORMATION

Course Code: EWCE 105	Credit Hour: 3.0
Course Title: Environmental Chemistry	Contact Hour: 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

The course is concerned with the interactions of chemicals (natural or artificial) in air, water, soils and sediments which help to understand the elements of pollution and their sources. Students will develop a firm knowledge of analytical chemistry to environmental processes which will be used in later semesters and also in professional fields.

OBJECTIVE

1. To understand the importance of 3R (Reuse, Reduce and Recycle) principle.
2. To understand the details of pollutant chemistry in atmosphere, water, soil and food as well as their adverse effects on environment and human health.
3. To describe the process chemistry involved in water and waste water treatment plants.
4. To understand the chemical mobilization from anthropogenic sources, like industrialization, agriculture, drug and food additives.

COURSE CONTENT

Fundamental of environmental chemistry, Green synthetic chemistry, concept of 3R (reuse, reduce and recycle).

Atmospheric chemistry: Atmospheric cycles, air pollution and pollutants - criteria and critical pollutants, ozone hole and stratospheric ozone depletion, chemical and photochemical reactions in atmosphere, hydrocarbons and photochemical smog.

Aquatic chemistry: Water properties, solubility of gases and solids, colloidal suspension, Complexation reactions, solution approaches for aqueous equilibrium, Aqueous carbonate system, general concept on – alkalinity, pH, capacity diagram, pE, electron activity, Redox equilibria, organic and inorganic pollutants, heavy metal contamination, adsorption isotherms, Chemical fate of pollutants.

Soil Chemistry: Soil Composition, acid-base and ion exchange equilibria in soil, pollution mobilization from farming.

Chemistry of pesticides, insecticides, anti-biotic and food preservatives.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Ability to understand the concept of 3R principle and relate with their day-to-day work environment.	√											
2	CO2: Ability to explain the chemical and biochemical principles of fundamental environmental processes in air, water, and soil.	√											
3	CO3: Ability to identify the pollution sources as well as understand the principals of pollutant removal and environmental fate of contaminants.		√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to understand the concept of 3R principle and relate with their day-to-day work environment.	1	C2	-	-	1	Assignment, Class Test, Final Exam
CO2	Ability to explain the chemical and biochemical principles of fundamental environmental processes in air, water, and soil.	1	C2, C3	-	-	1	Class Test, Mid-term, Final Exam
CO3	Ability to identify the pollution sources as well as understand the principals of pollutant removal and environmental fate of contaminants.	2	C2	-	-	3	Assignment, Class Test, Mid Term, Final Exam

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom’s Taxonomy:

C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	42
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	09 18 46
Formal Assessment a) Continuous Assessment b) Final Examination	2 3
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction to basic environmental chemistry	CT1
	02	Scopes and history of development of environmental chemistry	
	03	Introduction on aquatic chemistry	
2	04	Green synthetic chemistry	
	05	Concept of 3R (reuse, reduce and recycle)	
	06	Physical properties of water	
3	07	Composition, structure and evolution of atmosphere	Mid Term Exam
	08	Carbon cycle and nitrogen cycle	
	09	Chemical properties of water	
4	10	Introduction to chemistry of air pollution	
	11	Sources and effects of air pollutants	
	12	Non-aqueous phases in water	
5	13	CFCs	
	14	Ozone hole and stratospheric ozone depletion	
	15	Complex reactions in aqueous solutions	
6	16	Chemical and photochemical reactions in atmosphere I	
	17	Chemical and photochemical reactions in atmosphere II	
	18	Equilibrium problem solving I	
7	19	Hydrocarbons and photochemiocal smog	
	20	Introduction to effects of air pollution	
	21	Equilibrium problem solving II	
8	22	Greenhouse gas effects	CT2
	23	Aqueous carbonate system I	
	24	Aqueous carbonate system II, Alkalinity and acidity	
9	25	Climate change and its consequences	
	26	Water pollution and pollutants	
	27	Redox equilibria	
10	28	Basic introduction to monitoring of air quality	
	29	Organic pollutants in water	
	30	Chemistry of water quality monitoring and water	

		quality standards.	
11	31	Criteria pollutants and critical pollutants	
	32	Formation and composition of soil	
	33	Nutrients and pollutants in soil	
12	34	Analytical methods for monitoring air pollutants	CT3
	35	Chemical fates of pollutants	
	36	Metal dissolutions and precipitations	
13	37	Air quality standards	
	38	Adsorption of metals I	
	39	Adsorption of metals II	
14	40	Case study of air pollution incidents/ disasters	
	41	Biochemical properties and impacts of pesticides, insecticides	
	42	Biochemical properties and impacts of anti-biotic and food preservatives	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3
Final Exam	60%	CO1, CO2, CO3	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. Chemistry for Environmental Engineering – Clair N. Sawyer, Perry L. McCarty and Gene F. Parkin, 4th ed., McGraw Hill Inc.
2. Environmental Chemistry – Stanley E. Manahan., 8th ed., CRC Press.
3. Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters – Werner Stumm and James J Morgan, 3rd ed., Hoboken: Wiley, 2012.
4. Environmental Engineering – Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, McGraw Hill International Edition.

COURSE INFORMATION	
Course Code: EWCE 131	Credit Hour: 2.0
Course Title: Environment, Ecology and Water Resources	Contact Hour: 2.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

The purpose of this course is to introduce ecological levels of an organization, biogeochemical cycles, biodiversity loss, environmental and anthropogenic pollutants, their sources, and impacts on the environment and human health. Understanding ecological processes and loss will help to identify the areas of intervention for conservation in the practical field. A basic understanding of environmental pollutants and existing standards will help understand the importance of pollution abatement in later semesters as well as in professional fields

OBJECTIVE

1. To understand the basic concept of material transport and energy dissipation in various trophic levels, human induced alteration of biogeochemical and hydrologic cycles, biodiversity loss and its impacts on environment.

2. To understand the basics of pollutant from atmosphere, water and soil as well as their adverse effects on environment and human health. 3. To give basic idea about environmental rules and water quality standards. 4. To apprehend preliminary concept of environmental pollution and water resources issues and management
COURSE CONTENT
Background of ecology, ecosystem and bio-diversity, biogeochemical cycles, hydrologic cycle, human influence on biogeochemical cycles. Environmental Pollution, Environment and water resources standards, Environment and water Pollution Management, Water Resources Problems and Management.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: To understand the basic concept of material transport and energy dissipation in various trophic levels, human induced alteration of biogeochemical and hydrologic cycles, biodiversity loss and its impacts on environment.	√											
2	CO2: To understand the basics of pollutant from atmosphere, water and soil as well as their adverse effects on environment and human health.	√											
3	CO3: To give basic idea about environmental rules and water quality standards.	√											
4	CO4: To apprehend preliminary concept of environmental pollution and water resources issues and management		√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP (WP)	CA (EA)	KP (WK)	Assessment Methods
CO1	To understand the basic concept of material transport and energy dissipation in various trophic levels, human induced alteration of biogeochemical and hydrologic cycles, biodiversity loss and its impacts on environment.	1	C2	-	–	1	Class Test, Mid-term, Final Exam
CO2	To understand the basics of pollutant from atmosphere, water, and soil as well as their adverse effects on environment and human health.	1	C2	-	–	1	Class Test, Mid-term, Final Exam
CO3	To give basic idea about environmental rules and water quality standards.	2	C2	-	–	2	Class Test, Mid-term, Final Exam

CO4	To apprehend preliminary concept of environmental pollution and water resources issues and management	1	C1, C2			1	Class Test, Mid-term, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (2 hours/week × 14 weeks)	28
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 5 12 30
Formal Assessment • Continuous Assessment • Final Examination	 2 3
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	1	Basic concept on ecology, Scope and importance of ecology, Ecological levels of organization hierarchy	
	2	Elementary knowledge on ecological factors, Basic characteristics of ecosystem	
2	3	Ecosystem structure and components, Ecosystem footprint	
	4	Basics on biological diversity, Benefit from biodiversity, Threat to biodiversity	
3	5	Hydrologic cycle, Water Pollution	
	6	Biological evaluation, nature selection, symbiosis, Influence of geography and geology on biological diversity	Class Test
4	7	Ecological communities and food chain, Types of food chains	
	8	Source of Pollution, Quality of Water	
5	9	Energy partitioning in food chains and food webs, Ecological pyramids General aspects of biogeochemical cycles	
	10	Carbon cycle Nitrogen cycle, Phosphorus cycle	Mid-Term Exam
6	11	Air Pollutants, Source of Air pollution	
	12	Sulphur cycle, Nutrient and Eutrophication	

7	13	Water Pollutants	
	14	Causes of Soil Pollution	
8	15	Sources of water pollutants Adverse effects of water pollution	
	16	Soil Pollution Control strategy	
9	17	Source of Nuclear Pollution	Class Test
	18	Control of Nuclear Pollution	
10	19	Pollution from Agricultural activities	
	20	Control of pollution from agricultural activities	
11	21	Pollution due to Detergent and dye	
	22	Control of Pollution from detergent and dye	
12	23	Water pollution by synthetic polymers	Class Test
	24	Water pollution by pharmaceuticals	
13	25	Heavy metal pollution in aquatic ecosystem I	
	26	Environmental Laws and Regulations I	
14	27	Environmental Laws and Regulations II	
	28	Heavy metal pollution in aquatic ecosystem II	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO3, CO4	C1, C2
Final Exam	60%	CO1, CO2, CO3, CO4	C1, C2
Total Marks	100%		

REFERENCE BOOKS

1. Environmental Science – Earth as Living Planet - Daniel B. Botkin, Edward A. Keller, 8 th ed., John Wiley and Sons, Inc.
2. Environmental Science – A Global Concern - William P. Cunningham, Mary Ann Cunningham, 12th ed., McGraw Hill Companies
3. Fundamentals of Ecology - Eugene P. Odum, Gray W. Barrett, 5 th ed., Thomson Learning Inc.
4. Environmental Engineering – Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, McGraw Hill International Edition

COURSE INFORMATION	
Course Code: EWCE 200	Credit Hour: 1.5
Course Title: Details of Construction and Quantity Surveying	Contact Hour: 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will be introduced with components of different civil engineering. This hand on training will be useful for the students in later projects.

OBJECTIVE

1. To impart knowledge on the basics of different types of components of a building, design loads, framed structure and load bearing wall structure.

2. To impart knowledge on the basics of different structures like culvert, septic tank, water reservoir and retaining wall.
3. To make the students efficient in practical field through site visits and technical sessions.

COURSE CONTENT

Types of building, components of a building, design loads, framed structure and load bearing wall structure foundations: shallow and deep foundation, site exploration, bearing capacity of soil, brick masonry: types of brick, bonds in brickwork, supervision of brickwork, 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, cement concrete construction, house plumbing: water supply and wastewater drainage, estimating and cost analysis of a building, bridge, shore structures etc.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Able to understand the components of substructure and superstructure of a building, properties of construction materials, design loads, framed structure and load bearing wall structure	√											
2	CO2: Able to recognize different aspects of construction through field visit and team work									√			
3	CO3: Able to estimate the total material and cost required for different components of a residential building	√											
4	CO4: Able to determine the material required for different civil engineering structures such as culvert, septic tank, water reservoir and retaining wall	√											

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to understand the components of substructure and superstructure of a building, properties of construction materials, design loads, framed structure and load bearing wall structure	1	C2	-	–	3,4	Test, Quiz, Report
CO2	Able to recognize different aspects of construction through field visit and team work	9	C1	-	–	3	Test, Quiz, Report
CO3	Able to estimate the total material and cost required for different components of a residential building	1	C2	-	–	6	Test, Quiz, Report

CO4	Able to determine the material required for different civil engineering structures such as culvert, septic tank, water reservoir and retaining wall	1	C2	-	–	6	Test, Quiz, Report
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (2.5 hours/week × 12 weeks)	30
Guided Learning Tutorial/ Assignments (1 hours/week × 12 weeks)	12
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	 3 3 4
Formal Assessment c) Continuous Assessment d) Quiz and viva	 3 5
Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction, Parts of building, types of building, foundation	Assignment/Test
2	02	Brick and Concrete	
3	03	Estimation of brickworks, FA, CA, and Cement in Concrete	Assignment/Test
4	04	Stairs, Slabs, Lintel, and Arches	
5	05	Plastering, Paints, Varnishes	
6	06	House plumbing system, Design of water tank	
7	07	Calculation of volume of earthwork for road embankment	
8	08	Mid Quiz	Quiz
9	09	Estimating and cost analysis of a building 1	Assignment/Test
10	10	Estimating and cost analysis of a building 2	
11	11	Estimating and cost analysis of an embankment	Assignment/Test

12	12	Estimating and cost analysis of a culvert	
13	13	Estimating and cost analysis of a septic tank	
14	14	Final Quiz, Viva	Quiz

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Assignment/Test/ Mid Term/ Active Class Participation)	45%	CO1, CO2, CO3, CO4	C1.C2
Quiz	50%	CO1, CO2, CO3, CO4	C1.C2
Viva	5%	CO1, CO4	C2
Total Marks	100%		

REFERENCE BOOKS

1. Concrete and Formwork - T W Love
2. Building Construction – W.B. McKay (Vol. 1)
3. BDA Guide to Successful Brickwork - the Brick Development Association.
4. Concrete Construction - Ken Nolan
5. Building Construction – Sushil Kumar
6. Formwork for Concrete - M.K. Hurd, , Fifth Edition,
7. "New Scaffolding Guidance TG20:08 – Guide to Good Practice for Scaffolding with Tube and Fittings" NASC (National Access and Scaffolding Confederation), UK
8. Plumbing a House: For Pros by Pros - Peter Hemp
9. Building Construction – Dr. B.C. Punmia
10. Building Construction Engineering – Gurcharan Singh
11. Construction Drawings and Details for Interiors: Basic Skills, 2nd Edition - Rosemary Kilmer and W. Otie Kilmer
12. Sound Insulation- Carl Hopkins
13. Popular Mechanics Complete Home How-to - Albert Jackson, David Day
14. PWD manual on house construction and plumbing

COURSE INFORMATION	
Course Code: EWCE 201	Credit Hour: 3.0
Course Title: Construction Materials	Contact Hour: 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This course is very useful for civil engineering students. In this course students will be given knowledge on various engineering materials including but not limited to brick, cement, sand, coarse aggregate, mortar, concrete, wood, steel, aluminum, geo-textiles, composites, FRP, etc. Students will be also familiarizing with behavior and characteristics of these materials. Studying of these materials will be useful for the students in later projects.

OBJECTIVE

1. To gain knowledge on the basics of engineering materials.
2. To be able to identify the suitability of engineering materials in the construction of different civil engineering structures.
3. To be able to design concrete mix by appropriate methods.

COURSE CONTENT
Properties and uses of aggregates, brick, cement, sand, lime, mortars, concrete, marine concrete, concrete mix design, wood structures and properties, shrinkage and seasoning, treatment and durability, mechanical properties, creep behavior, advanced fiber reinforced polymer (FRP) composites, glass fiber, nano tubes, reinforcement types, corrosion prevention in RC structures, geotextiles and geo-synthetics, elastic, elastoplastic and elasto-visco-plastic materials, Ferro-cement.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	**11**	**12**
1	CO1: Able to **identify** the suitability of engineering materials for different types of construction works and the properties of construction materials.	√											
2	CO2: Able to **understand** the production process of major engineering materials (bricks, cement etc) and their uses.	√											
3	CO3: Able to **know** the basics of modern, green and high-performance civil engineering material.	√											
4	CO4: Able to **use** appropriate method to undertake basic design calculations for concrete mix.		√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to **identify** the suitability of engineering materials for different types of construction works and the properties of construction materials.	1	C2	–	–	4,5	Class Test, Mid-term, Final Exam
CO2	Able to **understand** the production process of major engineering materials (bricks, cement etc) and their uses.	1	C2	–	–	4,5	Class Test, Mid-term, Final Exam
CO3	Able to **know** the basics of modern, green and high-performance civil engineering material.	1	C2	–	–	3,4	Class Test, Mid-term, Final Exam
CO4	Able to **use** appropriate method to undertake basic design calculations for concrete mix.	2	C3	–	–	4	Class Test, Mid-term, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom’s Taxonomy:						

	C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create
	(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)					

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Guided Learning Tutorial/ Assignments (2 hours/week × 6 weeks)	12
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	 32 11 18
Formal Assessment a) Continuous Assessment b) Final Examination	 2 3
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction to CE materials	CT/Mid Term/Final Exam
	02	Brick: Definition, Characteristics, Classification, Manufacturing	
	03	Brick: Brick burning, Tests for bricks, Brick specifications	
2	04	Sand: Sources, Classification, Properties, Functions, Substitute	
	05	Sand: Functions, Uses, Tests, Bulking	
	06	Metals & Alloys: Definition, Effect of Impurities, Comparison	
3	07	Lime: Definition, Properties, Sources, Types, Hydraulicity	
	08	Lime: Classification, Slaking methods, Artificial hydraulic lime	
	09	Mortar & Plaster: Types, Uses, Characteristics, Functions	
4	10	Cement: Manufacture, Cement chemistry, Functions, Hydration	
	11	Cement: Major types, Other types, Testing of Cement	
	12	Ferro cement: Components, Uses	
5	13	Introduction to Concrete, Concrete Properties	CT/Mid Term/Final Exam
	14	Shrinkage and Creep of Concrete	
	15	Manufacturing of concrete	
6	16	Mix Design of Concrete: Design guidelines	
	17	ACI Mix design of concrete	
	18	ACI Mix design of concrete	
7	19	British method of mix design	
	20	Concrete production in Bangladesh	
	21	Concrete in hydraulic structures	
8	22	Stress-Strain Behavior: Definition, Figures	Final Exam
	23	Stress-Strain Behavior: Load-Strain Behavior of	

		materials	
	24	Rubber: Types, Properties, Uses	
9	25	Glass: Functions, Requirements, Properties, Classification, Uses	
	26	Paint: Functions, Constituents, Bases, Characteristics, Types	
	27	Varnish: Functions, Constituents, Characteristics, Types, Process	
10	28	Wood structures and properties mechanical properties	
	29	Shrinkage and seasoning, treatment and durability	
	30	Mechanical properties of timber	
11	31	Insulating Materials: Classification, Requirements, Types	
	32	Corrosion & Prevention	
	33	Causes & Prevention of corrosion	
12	34	Advanced fiber reinforced polymer (FRP) composites, reinforcement types	CT/Final Exam
	35	Glass fiber, nano tubes	
	36	Geotextiles and geo-synthetics	
13	37	Introduction to Coastal Structures	
	38	Materials used for hydraulic structures	
	39	Marine Concrete	
14	40	Riprap, Gabions, Geobag and Geotubes used for hydraulic structures	
	41	Materials used for river/sea bank protection	
	42	Review of design problems	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C3
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. Building Materials – Gurcharan Singh.
2. Engineering Materials - M.A. Aziz.
3. A Text book of Engineering Materials – G.J. Kulkarni (6th Edition).
4. Engineering Materials Technology: Structures, Processing, Properties, and Selection - James A. Jacobs and Thomas Kilduff, 5th Ed.

COURSE INFORMATION	
Course Code: EWCE 203	Credit Hour: 3.0
Course Title: Geology and Geomorphology	Contact Hour: 3.0

PRE-REQUISITE

CHEM 103, PHY 129

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will be given basic knowledge on how the earth formed, its typical structures, mineralogical composition of rocks, types of minerals and the processes acting on the earth. Students will be familiarized with geomorphological study of landforms and the processes that shape them. Students will also have the preliminary knowledge on seismological, geological, and geomorphological study of Bangladesh.

OBJECTIVE

1. To gain knowledge on the composition, structural formation of several types of rocks, minerals, and the seismicity in Bangladesh.
2. To attain insight on the common geomorphological formations emphasizing on the perspective of Bangladesh.

COURSE CONTENT

Formations of earth crusts and changes that occur on the earth's surface. Rocks and minerals: identification of rocks and minerals, common rock forming minerals, physical properties of minerals, mineralogist rocks, types of rocks, cycle of rock change, earthquake and seismicity of Bangladesh, geology of Bangladesh. Structural geology: faults, types of faults, fold and fold type, domes, basins, erosional process, quantitative analysis of erosional land forms. Fluvial processes in Geomorphology: channel development, channel widening, valley shape, stream terraces, alluvial flood plains, deltas and alluvial fans, fluvial deposits, coastal deposits, glacial deposits, lacustrine deposits, Aeolian deposit, river basin, channel morphology, channel patterns and the river basin, geology and geomorphology of rivers of Bangladesh.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Able to understand the typical formations and mineralogical compositions of rocks and the earth crust.	√											
2	CO2: Able to gain knowledge on earthquake, seismic hazards, and vulnerability in Bangladesh.		√										
3	CO3: Able to understand and synthesize the general trends in geomorphological study of land forms and its importance in riverine areas of Bangladesh.	√	√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to understand the typical formations and mineralogical compositions of rocks and the earth crust.	1	C1, C2	-	1	1	Class Test, Final Exam
CO2	Able to gain knowledge on earthquake, seismic hazards, and vulnerability in Bangladesh.	2	C2, C4	-	1	1,3	Class Test, Mid-term, Final Exam
CO3	Able to understand and synthesize the general trends in geomorphological study of land forms and its importance in riverine areas of Bangladesh.	1,2	C3, C4	-	1	1,4	Assignment, Class Test, Mid Term, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving;						

	EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Guided Learning Tutorial/ Assignments (2 hours/week × 6 weeks)	12
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	 11 18 32
Formal Assessment c) Continuous Assessment d) Final Examination	 2 3
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction to Minerals	CT1
	02	Introduction to Minerals	
	03	Quantitative analysis of erosional land forms	
2	04	Identification and common rock forming minerals	
	05	Identification and common rock forming minerals	
	06	Channel development	
3	07	Physical properties of minerals	Mid Term Exam
	08	Physical properties of minerals	
	09	Channel widening	
4	10	Physical properties of minerals	
	11	Mineraloids rocks	
	12	Valley shape	
5	13	Mineraloids rocks	
	14	Mineraloids rocks	
	15	Stream terraces	
6	16	Types and cycle of rock change	
	17	Types and cycle of rock change	
	18	Alluvial flood plains	
7	19	Earthquake and seismic map of Bangladesh	
	20	Earthquake and seismic map of Bangladesh	
	21	Deltas and alluvial fans	
8	22	Earthquake and seismic map of Bangladesh	CT2
	23	Earthquake and seismic map of Bangladesh	
	24	Structural geology	
9	25	Earthquake and seismic map of Bangladesh	
	26	Structural geology	

	27	Channel morphology	
10	28	Structural geology	
	29	Erosional process	
	30	Channel morphology	
11	31	Erosional process	
	32	Erosional process	
	33	Channel patterns and the river basin	
12	34	Erosional process	CT3
	35	Channel patterns and the river basin	
	36	Channel patterns and the river basin	
13	37	Erosional process	
	38	Geology and geomorphology of Bangladesh	
	39	Geology and geomorphology of Bangladesh	
14	40	Channel patterns and the river basin	
	41	Channel patterns and the river basin	
	42	Geology and geomorphology of Bangladesh	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C3, C4
Final Exam	60%	CO1, CO2, CO3	C1, C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Geology for Civil Engineers - A.C. McLean & C.D. Gribble
2. A Geology for Engineers - Blyth & Freitas (7th Edition)
3. Principles of Geomorphology - William D. Thornbury
4. A Geology for Engineers - F.G.H. Blyth
5. Physical Geology - Leet, L Don, Judson, Sheldon (2nd Edition)
6. Physical and Engineering Geology - S. K. Garg

COURSE INFORMATION

Course Code: EWCE 205	Credit Hour: 2.0
Course Title: Numerical Methods	Contact Hour: 2.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will be given basic knowledge of various numerical solution techniques and computations. This will be useful for the students in a later stage of their study, as well as professional life.

OBJECTIVE

1. To gain knowledge of the basic computations of numerical problems.
2. To become skilled in using numerical solution techniques.
3. To learn the schemes of reducing the numerical errors in basic computations.

COURSE CONTENT

Basics of Numerical Methods, Numerical solution of non-linear algebraic and transcendental equations, Systems of linear algebraic equations, interpolation and curve fitting, roots of equations, numerical differentiation, numerical integration, initial value problems, two-point

boundary value problems, and finite differences.													
SKILL MAPPING (CO – PO MAPPING)													
No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Ability to **understand** the fundamental concepts of various numerical techniques and to **distinguish** the difference between numerical and analytical solution methods.	√											
2	CO2: Ability to **analyze** the distinctive characteristics of various numerical techniques and the associated error measures.		√										
3	CO3: Ability to **apply** the principles of various numerical techniques to solve distinctive mathematical and engineering problems.		√										

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to **understand** the fundamental concepts of various numerical techniques and to **distinguish** the difference between numerical and analytical solution methods.	1	C2	-	–	3	Class Test, Mid- term, Final Exam
CO2	Ability to **analyze** the distinctive characteristics of various numerical techniques and the associated error measures.	2	C4, C5	-	–	3	Assignment, Class Test, Mid-term, Final Exam
CO3	Ability to **apply** the principles of various numerical techniques to solve distinctive mathematical and engineering problems	2	C3	-	–	3,4	Assignment, Class Test, Mid-term, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom’s Taxonomy: <u>C1-Remember</u> <u>C2-Understand</u> <u>C3-Apply</u> <u>C4-Analyze</u> <u>C5-Evaluate</u> <u>C6-Create</u> (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						
TEACHING AND LEARNING STRATEGY							

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	28 -- --
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for tests and examination	5 12 30
Formal Assessment • Continuous Assessment • Final Term Examination	2 3
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	1	Introduction to Numerical Methods	CT, Assignment, Mid Term, Final Exam
	2	Basics of Numerical Methods	
2	3	Numerical solution of non-linear algebraic equations: Concept	
	4	Numerical solution of non-linear algebraic equations: Problem	
3	5	Numerical solution of transcendental equations: Concept	Assignment, Mid Term, Final Exam
	6	Numerical solution of transcendental equations: Problem	
4	7	Systems of linear algebraic equations : Concept	
	8	Systems of linear algebraic equations : Problem	
5	9	Interpolation: Concept	
	10	Interpolation: Problem	
6	11	Curve fitting: Concept	
	12	Curve fitting: Problem	
7	13	Roots of equations: Concept	
	14	Roots of equations: Problem	
8	15	Numerical differentiation: Concept	CT, Assignment, Final Exam
	16	Numerical differentiation: Problem	
9	17	Numerical differentiation: Problem	
	18	Numerical integration: Concept	CT, Assignment, Final Exam
10	19	Numerical integration: Problem	
	20	Numerical integration: Problem	
11	21	Initial value problems: Concept	
	22	Initial value problems: Problem	
12	23	Two-point boundary value problems: Concept	
	24	Two-point boundary value problems: Problem	
13	25	Finite differences: Concept	Assignment, Final Exam
	26	Finite differences: Problem	
14	27	Finite differences: Problem	
	28	Finite differences: Problem	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy

Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3, C4, C5
Final Exam	60%	CO1, CO2, CO3	C2, C3, C4, C5
Total Marks	100%		

REFERENCE BOOKS

1. Numerical Mathematical Analysis – James b. Scarborough.
2. Introductory Methods of Numerical Analysis– S.S. Sastry.
3. Numerical Methods for Scientific And Engineering Computation - Jain, Iyengar, Jain.
4. Numerical Methods using Matlab (-John H Mathews and Kurtis K Fink, 4th Ed.
5. Fundamentals of Engineering Numerical Analysis - Parviz Moin (2010).

COURSE INFORMATION	
Course Code: EWCE 206	Credit Hour: 1.5
Course Title: GIS in Environmental and Water Resources Engineering	Contact Hour: 3.0

PRE-REQUISITE

EWCE - 103 (Surveying), EWCE - 104 (Practical Surveying)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This is a hand on training course for GIS in both environmental and water resources perspective. In this course students will be introduced to basic functions and analysis of GIS. Students will be also practice using GIS for conducting spatial analysis.

OBJECTIVE

1. To understand basic functions of GIS
2. To understand common formats of GIS data like shapefiles, raster, and geodatabases.
3. To produce maps for basic GIS analysis
4. To utilize GIS software for conducting spatial analysis

COURSE CONTENT

Introduction, use and applications of GIS software, map projection system, features of ArcGIS, hands-on exercises using basic GIS tools.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Ability to **define** the fundamental concepts and practices of Geographic Information Systems (GIS)	√											
2	Ability to **produce** maps from geographic data using visualization concepts such as color theory, symbolization and similar GIS tools	√											
3	Ability to **analyze** geospatial problems with the help of basic GIS analysis tools	√											
4	Ability to **create** spatial data from tabular information that includes a spatial reference and prepare a GIS layout					√							

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to **define** the fundamental concepts and practices of Geographic Information Systems (GIS)	1	C2	1	–	1,3	Class Assessment/ Quiz
CO2	Ability to **produce** maps from geographic data using visualization concepts such as color theory, symbolization, and similar GIS tools	1	C3	1	–	1,3	Class Assessment/ Quiz
CO3	Ability to **analyze** geospatial problems with the help of basic GIS analysis tools	1	C4	1	–	2,3	Class Assessment/ Quiz
CO4	Ability to **create** spatial data from tabular information that includes a spatial reference and prepare a GIS layout	5	C3	1	–	2,3	Assignment/ Quiz
	WP = Washington Accord Complex Problem Solving/ CP = Complex Problem Solving; EA = Engineering Activities/ CA = Complex Activities; WK = Washington Accord Knowledge Profile/ KP = Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture (3 hours/week × 11 weeks)	33
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 8 11 3
Formal Assessment • Continuous Assessment • Final Examination	 2 3
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	1	Introduction to basics of GIS and ArcGIS 10.8 Interface	Class Assessment
2	2	Introduction to basics of GIS and ArcGIS 10.8 Interface (continued)	
3	3	Map Design	

4	4	GIS Outputs	
5	5	Table Operation	
6	6	Geoprocessing	
7	7	Quiz	Quiz
8	8	File Geodatabase	
9	9	File Geodatabase (continued)	
10	10	Spatial Analysis	
11	11	Quiz	Quiz
12	12	Introduction to Maps, Map Projection, and coordinate Systems: Georeferencing	Assignment
13	13	Digitizing and Editing	
14	14	Quiz	Quiz

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Class assessment / Quiz / Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C3, C4
Quiz	60%	CO1, CO2, CO3, CO4	C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. "Concepts and Techniques of Geographic Information System" by – C.P. Lo Albert and K.W. Yeung
2. "Principles of Geographical Information System" by – Peter A. Burrough and Rachel A. McDonnel
3. "Geographical Information System and Computer Cartography" by - Christopher Jones

COURSE INFORMATION	
Course Code: EWCE 211	Credit Hour: 4.0
Course Title: Mechanics of Solids	Contact Hour: 4.0

PRE-REQUISITE

EWCE 101 (Analytical Mechanics)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This is a basic mechanics course. In this course, students will be introduced to basic solid mechanics including stress, strain, deformation, different loads, and behavior of structures under loading. Students will be able to design structural members considering different criteria and factors of safety.

OBJECTIVE

1. Grasp the internal force systems in frame members and compute the internal forces at various locations.
2. To obtain fundamental concepts of stress and strain and their relationships for structural materials (constitutive relations), various stresses due to load in structural

members such as bending, shear, and torsion. 3. To analyze the effect (state of stress) on the beam due to combined loading and transformation stresses (construction of Mohr's circles of stress). 4. To obtain fundamental concepts of Euler‘s buckling theory, the concept of strain energy for axial stress, flexural stress and shear stress and establish failure criteria by maximum distortion energy theory.
COURSE CONTENT
Concepts of stress and strain, stress transformation, Deformations due to tension, compression and temperature change, Thin walled pressure vessels, Elastic analysis of circular shafts subjected to torsion, 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, Flexural and shear stresses in beams, Symmetric and unsymmetric bending of beams, Beam deflection by direct integration method, Buckling of columns, Elastic strain energy and external work and Castigliano‘s theorem, Cable theorem, Cable supported structures.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to investigate the state of stress due to combined loading at beam and column and find neutral axis and deformation.	√											
2	CO2: Be able to calculate the deflection and rotation at any point of the beam under transverse loading using the direct integration method.	√											
3	CO3: Be able to design structural members considering strength, buckling, thermal stress and factors of safety.		√										
4	CO4: Be able to apply the concept of elastic strain energy to determine various deformation components in simple structural elements.		√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to investigate the state of stress due to combined loading at beam and column and find a neutral axis.	1	C2	1	–	5,6	Assignment, Pop quiz, Final Exam
CO2	Be able to calculate	1	C3	1	–	5,6	Class Test,

	the deflection and rotation at any point of the beam under transverse loading using direct integration method.						Mid-term, Pop quiz, Final Exam
CO3	Be able to design structural member considering strength, buckling, thermal stress and factor of safety.	2	C4	1	–	3	Class Test, Mid-term, Pop quiz, Final Exam
CO4	Be able apply the concept of elastic strain energy to determine various deformation components in simple structural elements.	2	C4	1	–	4	Class Test, Mid-term, Pop quiz, Final Exam

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture (4 hours/week × 14 weeks)	56
Tutorial/ Assignments (2 hours/week × 8 weeks)	16
Self- Directed Learning a) Non-face-to-face learning b) Revision of the previous lecture at home c) Preparation for final examination	 40 20 20
Formal Assessment • Continuous Assessment • Final Examination	 5 3
Total	160

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	1	Concept of stress, strain, allowable stress.	CT1
	2	Problem solving: Stress, Strain, Shear Stress, Shear strain	
	3	Problem solving: Stress, Strain, Shear Stress, Shear strain	
	4	Statically Indeterminate axial loaded member	

2	5	Statically Indeterminate axial loaded member	
	6	Thermal Stress	CT2
	7	Thin-walled pressure vessel	
	8	Thin-walled pressure vessel	
3	9	Change of length and diameter of pressure vessel using generalized Hook's law	
	10	Basic assumptions for circular members in torsion, Torsion Formula, Torsion stress diagram for circular solid, hollow bar and bar with different materials.	
	11	Angle of twist of circular member	
	12	Design of circular members in torsion for strength, Stress Concentrations	
4	13	Design of circular members in torsion for strength, Stress Concentrations	
	14	Basic concept of transformation of stress. Transformation of stresses in 2D problems.	
	15	Principal stresses 2D problems. Maximum shear stresses in 2D problems	
	16	Practice Problem-Transformation of stress by derived formula.	
5	17	Derive the equation for Mohr's circle of stress for 2D problems.	
	18	Practice problems with the help of Mohr's circle of stress transform the stress at principal stress and maximum normal stress.	
	19	Practice problems with the help of Mohr's circle of stress transform the stress at principal stress and maximum normal stress.	
	20	Practice problems with the help of Mohr's circle of stress find the value of normal and shear stress at an angle of stress	
6	21	Free body diagram and equations of statics for beam. Internal force at a particular section.	CT3
	22	Inclined force on Beam and equilibrium, Sign convention for drawing shear force and bending moment diagram.	
	23	Practice Shear Force and Bending Moment Diagram of Beam	
	24	Practice Shear Force and Bending Moment Diagram of Beam	
7	25	Practice Shear Force and Bending Moment Diagram of Beam	
	26	Practice Shear Force and Bending Moment Diagram of Beam	
	27	Practice Shear Force and Bending Moment Diagram of Beam	
	28	Free body diagram of Frame	
8	29	Practice Axial force, Shear Force and Bending Moment Diagram of Frame	Mid Term
	30	Practice Axial force, Shear Force and Bending Moment Diagram of Frame	
	31	Introduction to flexure stress and Flexure formula, flexure stress	

	32	Bending Deformation of a straight Member	
9	33	Determination of stress due to bending in different cross section.	
	34	Determination of stress due to bending in different cross section.	
	35	Shear stress in Straight Members.	
	36	Shear stress distribution along depth of a beam.	
10	37	Components of skew bending and related formula overview.	
	38	Basic formula of skew bending. Bending about both principal axes.	
	39	Problem on skew bending	
	40	Problem on skew bending	
11	41	Derivation of 2^{nd} and 4^{th} order differential equation of deflection of beam (direct integration method)	CT4
	42	Derivation of equation of elastic curve of beams: simply supported with (uniformly distributed load, uniformly varying load)	
	43	Deflection of beam using direct integration method: Fixed supported with (uniformly distributed load, uniformly varying load)	
	44	Deflection of beam using direct integration method: Simply supported with (point loading, discontinuous UDL, Concentrated moment)	
12	45	Indeterminate beam (calculation of reaction & SFD, BMD) solve using direct integration method.	
	46	Introduction to Cable Theory and Cable supported structures	
	47	Problems of Cable Theorem	
	48	Problems of Cable Theorem	
13	49	Introduction to Buckling of column, related definitions and concepts.	
	50	Derivation of Euler's Load for columns with pin ends. Euler Load for columns with different end restraints.	
	51	Find critical load/stress/cross section/end restraint using Euler Formula, Analysis of W section using AISC ASD and LRFD formula.	
	52	Design of W section for given load using AISC ASD/LRFD formula.	
14	53	Elastic Strain Energy: basic concept (stain energy density, Total strain energy)	
	54	Structure with axial loading and bending (Total strain energy)-problems	
	55	Elastic Strain Energy: structure with Shear stress and strain	
	56	Castigliano's theorem	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment	40%	CO1, CO2, CO3, CO4	C2, C3, C4

(Class assignments/ CT/ Mid Term/ Active Class Participation)			
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C3, C4
Total Marks	100%		
REFERENCE BOOKS			

1. Engineering Mechanics of Solids – Egor P. Popov (2nd Ed.).
2. Mechanics of Materials (6th Edition) - Ferdinand P. Beer,E. R.Johnston,John T. Dewolf and David F. Mazurek.
3. Mechanics of Materials (10th Edition) - R. C. Hibbeler.
4. Theory and Problems of Strength of Materials - William A Nash.
5. Advanced Strength and Applied Elasticity, (5th Edition) - A C Ugural and S K Fenster.
6. Mechanics of Materials by Laurson & Cox.
7. Strength of Materials by R.Khurmi.

COURSE INFORMATION	
Course Code: EWCE 212	Credit Hour: 1.5
Course Title: Structural Mechanics and Materials Sessional	Contact Hour: 3.0
PRE-REQUISITE	
EWCE-201 (Construction Materials), EWCE-211 (Mechanics of Solids)	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
This is a hand on training course for engineering materials and mechanics. In this course students will introduce to basic testing procedure for brick, cement, sand, stone, concrete, and steel. Students will be also learning testing of different structures.	
OBJECTIVE	
1. To gain knowledge on the basic properties of engineering materials. 2. Identify the strength of cement, aggregate, steel, concrete and brick. 3. Identify the strength and deflection of different structural members. 4. To recognize the appropriate relevant design codes through experiments.	
COURSE CONTENT	
Tension, direct shear and impact tests of mild steel specimen, slender column test, static bending test, hardness test of metals, helical spring test, General discussion on preparation and properties of concrete, FM of aggregates, normal consistency, initial setting time, soundness and fineness test of cement, compressive strengths of cement mortar, design and testing of a concrete mix and testing of bricks for compressive strength.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to **identify** the engineering properties of cement, aggregate, steel and brick.	√											
2	CO2: Be expert in **describing** the strength and deflection of different structural members.	√											
3	CO3: Be able to **recognize** the appropriate relevant design codes through experiments.				√								

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **identify** the engineering properties of cement, aggregate, steel and brick.	1	C1	-	–	3	Test, Quiz, Report, Assignment
CO2	Be expert in **describing** the strength and deflection of different structural members.	1	C2	-	–	5,6	Test, Quiz, Report, Assignment
CO3	Be able to **recognize** the appropriate relevant design codes through experiments.	4	C1	-	–	5,6	Test, Quiz, Report, Assignment

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA=
Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile
*Level of Bloom's Taxonomy:
C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture (3 hours/week × 12 weeks)	36
Guided Learning Tutorial/ Assignments (1 hours/week × 12 weeks)	12
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	 1 2 3
Formal Assessment a) Continuous Assessment b) Quiz and viva	 2 4
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Normal consistency and initial setting time of cement with 'Vicat's Apparatus'	Assessment/Assignment
2	02	Sieve Analysis of fine and coarse aggregate	
3	03	Specific gravity and absorption capacity of coarse and fine aggregates. Unit weight and voids in aggregates.	

4	04	Direct compressive strength of cement mortar.	Assessment/Assignment
5	05	Compressive strength of cylindrical concrete specimen.	
6	06	Determination of compressive strength and absorption capacity of bricks.	
7	07	Mid Quiz	Quiz
8	08	Tension tests of mild steel specimen.	Assessment/Assignment
9	09	Direct shear and impact tests of mild steel specimen	
10	10	Hardness test of metals	
11	11	Slender column test	Assessment/Assignment
12	12	Helical spring test	
13	13	Static bending test	
14	14	Final Quiz, Viva	Quiz

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Assignment/Test/ Mid Term/ Active Class Participation)	45%	CO1, CO2, CO3	C1.C2
Quiz	50%	CO1, CO2, CO3	C1.C2
Viva	5%	CO1, CO3	C1
Total Marks	100%		

REFERENCE BOOKS

1. Engineering Mechanics of Solids by – Popov.
2. Theory and Problems of Strength of Materials by -William A Nash.
3. Laboratory Manual.
4. Bear and Johnson.

COURSE INFORMATION	
Course Code: EWCE 213	Credit Hour: 3.0
Course Title: Structural Analysis I	Contact Hour: 3.0

PRE-REQUISITE

EWCE 101 (Analytical Mechanics) , EWCE 211 (Mechanics of Solids)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will learn how to analysis various structural components subjected to both static and moving loads. Analysis technique learnt here will be useful in later courses where students will learn how to design different structural components. Knowledge gained from this course will be used in later semesters and in professional life.

OBJECTIVE

1. To analyze the statically determinate linear structural systems such as simple beams, cantilever beams, three-hinged arches, or frames.

2. To analyze statically indeterminate structures such as frames, and trusses subjected to dead load, lateral, gravity and thermal load.
3. To analyze structures for moving load.
4. To construct an influence line diagram for the beam, frame and truss.
5. To draw internal force diagrams and calculate the displacements.

COURSE CONTENT

The concept of stability and determinacy of structures, Analysis of statically determinate frames, trusses and arches, Approximate analysis of statically indeterminate structures: Portal Frames. Bridge Portal, Mil bent, Braced trusses, Analysis of multistoried building frames under gravity (vertical) load, Analysis of multi-storied building frames under lateral (wind and seismic) load: Portal method and Cantilever method, Deflection of beams, trusses and frames by energy method (strain energy, principles of virtual work), Influence lines, Moving loads on beams, Analysis of suspension bridge, Wind and earthquake loads.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to **analyze** statically determinate and indeterminate problems.		√										
2	CO2: Be able to **determine** lateral (gravity, wind, and seismic load) loads on structures in different areas of Bangladesh.		√										
3	CO3: Be able to **develop** knowledge of various types of structures and their load response.	√	√										
4	CO4: Be able to **determine** the axial load on columns of multistoried buildings.		√										
5	CO5: Be able to **analyze** the effect of moving loads on statically determinate structures.		√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **analyze** statically determinate and indeterminate problems.	2	C4	1	-	5, 6	Class Test, Mid-term, Final Exam

CO2	Be able to **determine** lateral (gravity, wind, and seismic load) loads on structures in different areas of Bangladesh.	2	C4, C5	1	-	5, 6	Presentation, Mid-term, Final Exam
CO3	Be able to **develop** knowledge of various types of structures and their load response.	1, 2	C2, C5	1	-	3	Class Test, Assignment, Final Exam
CO4	Be able to **determine** the axial load on columns of multistoried buildings.	2	C4	1	-	4, 5, 6	Assignment, Final Exam
CO5	Be able to **analyze** the effect of moving loads on statically determinate structures.	2	C4	1	-	2, 3	Class Test, Final Exam

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA=
Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile
*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (4 hours/week × 14 weeks)	56
Guided Learning Tutorial/ Assignments (3 hours/week × 6 weeks)	18
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	40 16 25
Formal Assessment c) Continuous Assessment d) Final Examination	2 3
Total	160

TEACHING METHODOLOGY

Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Stability and determinacy of structure	
	02	Stability and determinacy of structure	
	03	Earthquake load calculation as per BNBC-1993	
	04	Earthquake load calculation as per BNBC-1993	
2	05	Analysis of statically determinant truss	
	06	Analysis of statically determinant truss	
	07	Earthquake load calculation as per BNBC-	

		2014	
	08	Earthquake load calculation as per BNBC-2014	
3	09	Analysis of statically determinant arches	
	10	Analysis of statically determinant arches	
	11	Wind load calculation as per BNBC- 1993	
	12	Wind load calculation as per BNBC- 1993	
4	13	Analysis of statically determinant arches	CT 1
	14	Analysis of statically determinant arches	
	15	Wind load calculation as per BNBC- 2014	
	16	Wind load calculation as per BNBC- 2014	
5	17	Influence line of beams	
	18	Influence line of beams	
	19	Approximate analysis of statically indeterminate truss	
	20	Approximate analysis of statically indeterminate truss	
6	21	Influence line of beams	Mid Term Exam
	22	Influence line of beams	
	23	Approximate analysis of statically indeterminate portal frame subjected to vertical load.	
	24	Approximate analysis of statically indeterminate portal frame subjected to vertical load.	
7	25	Influence line of truss	
	26	Influence line of truss	
	27	Approximate analysis of statically indeterminate portal frame subjected to lateral load using portal method	
	28	Approximate analysis of statically indeterminate portal frame subjected to lateral load using portal method	
8	29	Influence line of truss	CT 2
	30	Influence line of truss	
	31	Approximate analysis of statically indeterminate portal frame using cantilever method	
	32	Approximate analysis of statically indeterminate portal frame using cantilever method	
9	33	Moving load on beams	
	34	Moving load on beams	
	35	Approximate analysis of tower truss	
	36	Approximate analysis of tower truss	
10	37	Moving load on beams	CT 3
	38	Moving load on beams	
	39	Approximate analysis of tower truss	
	40	Approximate analysis of tower truss	
11	41	Moving load on frame	
	42	Moving load on frame	
	43	Principle of work and energy. Principle of virtual work	
	44	Analysis and deflection calculation of truss using method of virtual work	

12	45	Moving load on frame	CT 4
	46	Moving load on frame	
	47	Introduction to Castigliano's theorem	
	48	Analysis and deflection calculation of truss using Castigliano's theorem	
13	49	Analysis of suspension bridge	
	50	Analysis of suspension bridge	
	51	Analysis and deflection calculation of beam using method of virtual work	
	52	Analysis and deflection calculation of frame using method of virtual work	
14	53	Analysis of suspension bridge	
	54	Analysis of suspension bridge	
	55	Analysis and deflection calculation of beam using Castigliano's theorem	
	56	Analysis and deflection calculation of frame using Castigliano's theorem	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4, CO5	C2, C4, C5
Final Exam	60%	CO1, CO2, CO3, CO4, CO5	C2, C4, C5
Total Marks	100%		

REFERENCE BOOKS

1. Structural Analysis, R C. Hibbeler, Prentice Hall, 8th Edition.
2. Elementary Structural analysis – C.H.Norris, J.B.Wilbur, I, utku
3. Theory of simple structures- TC Shedd and J. Vawter
4. Structural Analysis – Aslam Kassimali
5. Bangladesh National Building Code (BNBC,1993/2017)

COURSE INFORMATION

Course Code: EWCE 261	Credit Hour: 3.0
Course Title: Fluid Mechanics	Contact Hour: 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This course will be helpful for students to learn how to analyze the fluid properties; fluid statics; kinematics of fluid flows; fluid flow concepts and basic equations- continuity equation, Bernoulli's equation, energy equation, momentum equation and forces in fluid flow; steady incompressible flow in pressure conduits, laminar and turbulent flow. In this course, students will also be introduced with the concept of general equation for fluid friction; empirical equations for pipe flow; minor losses in pipe flow; pipe flow problems-pipes in series and parallel, branching pipes, pipe networks etc. which will be useful in various projects in the later semesters and in their professional life.

OBJECTIVE

1. To learn the basic properties of fluid and their applications,
2. To understand the governing equations of fluid flow i.e. continuity, energy, and momentum equations,
3. To learn fundamental concepts in designing pipes and analysis of pipe networks.

COURSE CONTENT
Fluid properties, fluid statics, kinematics of fluid flows, fluid flow concepts and basic equations- continuity equation, Bernoulli's equation, energy equation, momentum equation and forces in fluid flow, 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, pipe flow problems-pipes in series and parallel, branching pipes, pipe networks.

SKILL MAPPING (CO – PO MAPPING)													
No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: **Understand** the essential fluid properties, including viscosity, density, and compressibility, and their influence on fluid behavior	√											
2	CO2: **Apply** fluid statics principles to analyze and calculate pressures and forces within fluids at rest, and demonstrate proficiency in determining equilibrium conditions in various fluid systems.	√											
3	CO3: **Analyze** fluid motion through the study of kinematics, including velocity and acceleration fields, streamlines, and path lines.		√										
4	CO4: **Apply** the fundamental equations governing fluid flow, including the continuity equation, Bernoulli's equation, energy equation, and momentum equation and **analyze** and solve problems related to fluid behavior in various scenarios		√										
5	CO5: **Analyze** steady, incompressible flow in pressure conduits, understanding the concepts of laminar and turbulent flow, and applying empirical equations for pipe flow		√										

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	**Understand** the essential fluid properties, including viscosity,	1	C2	–	–	1	Pop Quiz,

	density, and compressibility, and their influence on fluid behavior						Final Exam
CO2	**Apply** fluid statics principles to analyze and calculate pressures and forces within fluids at rest, and demonstrate proficiency in determining equilibrium conditions in various fluid systems.	1	C3	–	–	1	Class Test, Mid-Term, Final Exam
CO3	**Analyze** fluid motion through the study of kinematics, including velocity and acceleration fields, streamlines, and path lines.	2	C4	–	–	1	Mid-Term, Final Exam
CO4	**Apply** the fundamental equations governing fluid flow, including the continuity equation, Bernoulli's equation, energy equation, and momentum equation and **analyze** and solve problems related to fluid behavior in various scenarios	2	C3, C4	–	–	1	Class Test, Mid-Term, Final Exam
CO5	**Analyze** steady, incompressible flow in pressure conduits, understanding the concepts of laminar and turbulent flow, and applying empirical equations for pipe flow	2	C4	–	–	1	Class Test, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember, C2 – Understand, C3- Apply, C4 – Analyze, C5 - Evaluate, C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Self- Directed Learning ● Non-face-to-face learning ● Revision of the previous lecture at home ● Preparation for final examination	09 18 46
Formal Assessment ● Continuous Assessment ● Final Examination	02 03
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	1	Introduction to Fluids and Fluid Mechanics	CT/ Assignment/ Final Exam
	2	Definition of a fluid, shear, strain rate and viscosity	
	3	Different type of fluid flow	
2	4	Fluid properties: density, pressure etc.	
	5	Dynamic and Kinematic viscosity	
	6	Surface Tension	
3	7	Fluid Statics: Pascal's law	
	8	Variation of pressure, Manometers	
	9	Forces on plane surface – concept and problem	
4	10	Forces on inclined surface	CT/ Assignment/ Final Exam
	11	Forces on curved surface – concept	
	12	Forces on curved surface – problem	
5	13	Laminar and Turbulent Flows - Concept	
	14	Laminar and Turbulent Flows - Problem	
	15	Steady, Unsteady, Uniform, Non-uniform Flows	
6	16	1D, 2D and 3D Flows	Mid Term/ Assignment/ Final Exam
	17	Streamlines, Path lines and Stream tubes - Concept	
	18	Streamlines and Path lines - Problem	
7	19	Continuity Equation for 1D Steady Flow	
	20	Stream Function, Potential Function and Flow net	
	21	Various Types of Energy in Fluid Flow	
8	22	Bernoulli's Equation	
	23	Kinetic Energy Coefficient – Concept and Problem	
	24	Energy Equation for 1D Steady Flow	
9	25	Total Energy Line and Hydraulic Grade Line, Cavitations	
	26	Head and Power - Pump	
	27	Head and Power - Turbine	
10	28	Linear Momentum Equation	
	29	Momentum Coefficient	
	30	Force Exerted on Pressure Conduits	
11	31	Force Exerted on Stationary Vane	
	32	Force Exerted on Moving Vane	
	33	Reaction of a Jet	
12	34	Flow in pressure conduits	CT/ Assignment/ Final Exam
	35	General equation for fluid friction	
	36	Darcy-Weisbach and Hagen-Poisevielle Equation	
13	37	Major and minor losses in pipe flow	
	38	Pipes in series, expansions and contractions, loss coefficients	
	39	Pipes in parallel, equivalent lengths	
14	40	Branching pipes	
	41	Pipe networks, Hardy-Cross method	
	42	Pipe networks, multiple pipe systems	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO4	C2, C3
Final Exam	60%	CO2, CO3, CO5	C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Fluid Mechanics with Engineering Application – Franzini
2. Fluid Mechanics– Streeter & Wylie
3. Fluid Mechanics – Frank M.White

COURSE INFORMATION	
Course Code: EWCE 262	Credit Hour: 1.5
Course Title: Fluid Mechanics Sessional	Contact Hour: 3.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
It is a sessional course where students can have a hand on experiment about the center of pressure; proof of Bernoulli's theorem; flow through venturi meter; flow through orifice; coefficient of discharge; coefficient of resistance; flow over v-notch; flow over sharp-crested weir; fluid friction in pipe etc. which will be useful in their professional life.	
OBJECTIVE	
1. To understand the basic principles of fluid mechanics, 2. To apply the basic principles to solve hydraulic engineering problems, 3. To apply the theoretical knowledge to carry out experimental investigations of fluid problems.	
COURSE CONTENT	
Centre of pressure; proof of Bernoulli's theorem; flow through venturi meter; flow through orifice; coefficient of discharge; coefficient of resistance; flow over v-notch; flow over sharp-crested weir; fluid friction in pipe; computer applications in solving pipe network problems.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: **Understand** the basic principles of fluid mechanics.	√											
2	CO2: **Apply** the basic principles of fluid mechanics to solve hydraulic engineering problems.		√										
3	CO3: **Apply** the theoretical knowledge to carry out experimental investigations of fluid problems.		√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	**Understand** the basic principles of fluid mechanics i.e., Bernoulli's theorem, continuity equation, Reynold's number, Froude number etc.	1	C2	1	-	5	Report, Quiz
CO2	**Apply** the basic principles of fluid mechanics to solve hydraulic engineering problems i.e., determining friction factor in a closed conduit, relationship between discharge and total	2	C3	1	-	3, 6	Report, Quiz

	head etc.						
CO3	**Apply** the theoretical knowledge to carry out experiment and investigations of fluid problems.	2	C3	1	-	3, 5	Report, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture (3 hours/week × 10 weeks)	30
Guided Learning • Report Writing (1 hour/week x 9 weeks)	10
Independent Learning • Individual learning	10 08
Assessment • Quiz +Viva	2
Total	60

TEACHING METHODOLOGY
Lecture, Tutorial, Practice and Class Assessment

COURSE SCHEDULE

Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	1	Introduction	R, Asg/T
2	2	Proof of Bernoulli's Equation	
3	3	Flow through a Venturi Meter	
4	4	Flow through an Orifice	
5	5	Flow Over a Sharp crested Rectangular Weir	
6	6	Flow over a V-notch	
7	7	Mid Term Exam	Mid Quiz
8	8	Fluid Friction in a Pipe	R, Asg/T
9	9	Determination of Co-efficient of Resistance for Change in CrossSection of Pipe	
10	10	Determination of Co-efficient of Discharge using Orifice Discharge Apparatus	
11	11	Determination of Centre of Pressure	
12	12	Final Exam	Final Quiz

13	13	Viva	

ASSESSMENT STRATEGY				
Components		**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (40%)	Lab Report/Class Assessment/Assignments	20%	CO1, CO2	C2, C3
	Class Participation	5%	CO1, CO2, CO3	C2, C3
	Mid Term	25%	CO1, CO2, CO3	C2, C3
Final Exam		50%	CO1	C2
			CO2	C3
			CO3	C3
Total Marks		100%		

REFERENCE BOOKS

1. Fluid Mechanics Sessional Lab Manual Open Channel Flow by V.T. Chow
2. Fluid Mechanics with Engineering Application by Franzini
3. Mechanics of fluids by Merle Potter and David Wiggert (Schaum's Series)

COURSE INFORMATION	
Course Code: EWCE 300	Credit Hour: 1
Course Title: Students' Internship Program (SIP)	Contact Hour: 4 weeks

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course the students will learn to communicate with industrial/ professional organizations/ personnel as well as to be introduced with organizational/ project activities where they will find the application of their theoretical knowledge. Real life exposure of the students through this course will be very helpful in their professional life.

OBJECTIVE

1. To apply class room knowledge in solving real life engineering problems.
2. To experience corporate culture and its contribution for the society.

COURSE CONTENT

Professional attachment in civil/ environmental/ water resources engineering related job/work at projects/organization/firms prescribed by the department. Performance will be evaluated based on a presentation and a report submitted by the intern and evaluation of the reporting officer at the organization/firm.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Ability to **gain** practical professional experience in civil/ environmental/ water resources engineering	√											

2	CO2: Ability to **work** effectively as an individual and also as a member of a team during industrial attachment									√			
3	CO3: Ability to **develop** an appreciation of the breadth of civil/ environmental/ water resources engineering which helps to gain life-long learning capability.												√
4	CO4: Ability to **perform** verbal presentation on the gained knowledge										√		

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to **gain** practical professional experience in civil/ environmental/ water resources engineering	1	C2	1	-	6, 7	Presentation, Report, VIVA
CO2	Ability to **work** effectively as an individual and also as a member of a team during industrial attachment	9	C3	2, 6, 7	-	6, 7	Presentation, Report, VIVA
CO3	Ability to **develop** an appreciation of the breadth of civil/ environmental/ water resources engineering which helps to gain life-long learning capability	12	C3	2, 6, 7	-	6, 7	Presentation, Report, VIVA
CO4	Ability to **perform** verbal presentation on the gained knowledge	10	C2	1	-	2	Presentation, Report, VIVA

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio	40

• Student – Centered Learning	
Guided Learning Report (2 hours/week x 1 weeks)	10
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	7
Assessment Presentation + Viva	3
Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Visit of one industry	Presentation, Report, VIVA
2	02	Visit of another industry	
3	03	Preparing report based on their gather knowledge during industrial training Preparing presentation for shearing gathered knowledge Preparation for viva	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Report)	50%	CO1, CO2, CO3, CO4	C2, C3
Presentation & VIVA	50%	CO1, CO2, CO3, CO4	C2, C3
Total Marks	100%		

REFERENCE BOOKS
N/A

COURSE INFORMATION	
Course Code: EWCE 331	Credit Hour: 3.0
Course Title: Water Supply Engineering	Contact Hour: 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will be presented with basic knowledge on water supply system, surface water collection, treatment and distribution, and water quality requirement. Knowledge gained from this course will be used in later semesters and also in professional life.

OBJECTIVE

1. To gain knowledge on the basics of water supply technology.
2. To become skilled at the design and construction of surface water treatment plant, ground water well and water distribution networks.
3. To get acquainted with low-cost water supply options for rural communities and draught vulnerable areas
4. To devise the theories for well hydraulics.

COURSE CONTENT
Introduction to Water Supply Engineering, Water requirement in urban and rural communities, low-cost water supply option, Sources of water supply, Theory of ground water, well hydraulics, types of wells and pumps, Design, drilling, construction and maintenance of wells, Rain water harvesting system and alternative water supplies for water stressed areas, Surface water collection, transportation, Analysis and design of distribution network, Fire hydrants, Water meters, Water loss control, Water quality requirements, Bangladesh and international standards, Water treatment methods, Climate resilient water safety plan (CRWSP).

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Ability to e**stimate** the fresh water demand and assess the requirements for preferred water supply system in urban as well as rural areas.	√											
2	Ability to i**dentify** problem specific solutions to provide fresh water supply options including groundwater well and RWH in urban as well extremely water shortage areas.	√											
3	Ability to **apply** engineering perception to construct complex water supply distribution networks in terms of economic, public health, Environment and sustainability							√					
4	Ability to **analyse** water quality data and related treatment methods to design and construct efficient and cost-effective water treatment plant, with appropriate consideration for public health and safety.			√									

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’s Taxonomy*	CP (WP)	CA (EA)	KP (WK)	Assessment Methods
CO1	Ability to e**stimate** the fresh water demand and assess the requirements for preferred water supply system in urban as well as rural areas.	1	C2	1	–	3	Class Test, Mid-term, Final Exam
CO2	Ability to i**dentify** problem specific solutions to provide fresh water supply options including groundwater well and RWH in urban as well extremely water shortage areas.	1	C2	1	–	3	Class Test, Mid-term, Final Exam
CO3	Ability to **apply** Engineering perception to construct complex water supply	7	C3	3	3	5	Class Test, Mid-term, Group

	distribution networks in terms of economic, public health, environment, and sustainability						Assignment Final Exam
CO4	Ability to **analyze** water quality data and related treatment methods to design and construct efficient and cost-effective water treatment plant, with appropriate consideration for public health and safety.	3	C4	2	–	4	Class Test, Mid-term, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home Preparation for final examination	24 11 20
Formal Assessment • Continuous Assessment • Final Examination	20 3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	1	Background of Environmental Engineering, water supply, health and sanitation, history and development of water supply engineering	
	2	Importance of water supply Eng., Elements of public water supply, Sources of water supply	
	3	Environment and Environmental impacts on Human Life, Water supply, health and sanitation, Ecology and Environment, Role of Environmental Engineer	
2	4	Population Estimation and water demand forecasting	
	5	Fire demand calculation and fire hydrant design	
	6	Suitability of sources with regards to quantity and quality, Choice of sources for water supply	
3	7	Aquifer properties, basic definitions, types of aquifers, confined and unconfined aquifers	Class Test
	8	Groundwater hydraulics, porosity, seepage, infiltration, permeability	
	9	Surface water collection units, Water treatment units	

4	10	Darcy's law, discharge equation for confined aquifers with example problems	
	11	Discharge equation for unconfined aquifers with example problems	
	12	Water distribution system, Distribution methods	
5	13	Withdrawal of excessive groundwater, consequences of groundwater abstraction	Group Assignment
	14	Basic concept of water well design, sieve analysis, bore hole construction	
	15	Water transmission line design	
6	16	Gravel pack design	
	17	Well drilling and construction	
	18	Single pipe design, serial, and branched networks	
7	19	Water well maintenance	Mid-Term Exam
	20	Problems of groundwater in Bangladesh	
	21	Looped networks, Hardy Cross Method	
8	22	Pump and pumping machineries, Requirement of water pump	
	23	Water impurities, water quality requirements	
	24	Water quality standards	
9	25	Plain sedimentation	
	26	Coagulation, Flocculation	
	27	Pump performance curve	
10	28	Filtration	Class Test
	29	Disinfection	
	30	Surface water intake design	
11	31	Iron and Manganese removal	
	32	Arsenic removal	
	33	Water supply in coastal saline affected areas	
12	34	Alternative and Low-cost water supply options	
	35	Taste and odour control	
	36	Water softening	
13	37	Auditing of water, Leak detection in water mains, Using water efficient appliances and fixture	Class Test
	38	Advanced Oxidation, Membrane technologies – reverse osmosis	
	39	Introduction to nanotechnology in environmental engineering	
14	40	Water safety through water safety plans, Water demand management, Water charging/ tariff, Water conservation	
	41	Developing a WSP	
	42	Review of water treatment options with examples	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2	C2, C3
Final Exam	60%	CO3, CO4	C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Water Supply Engg. MA Aziz.
2. Water Supply and Sanitation, M Feroze Ahmed and MM Rahman.
3. Groundwater Hydrology, 3rd Edition, David Keith Todd, Larry W. Mays.

4. Principles of Water Treatment, Kerry J. Howe, David W. Hand.
5. Water Supply Engineering, SK Gerg.
6. Integrated Design and Operation of Water Treatment Facilities (2nd Edition). Susumu Kawamura.
7. Water Safety Plan (WSP) – A Risk Based Approach for Water Safety 1st Ed., ITN-BUET.
8. Water and Environmental Engineering: M. Habibur Rahman, Abdullah Al-Muyeed, 1st Ed., ITN-BUET.

COURSE INFORMATION	
Course Code: EWCE 332	Credit Hour: 1.5
Course Title: Environmental Engineering Sessional-I	Contact Hour: 3.0
PRE-REQUISITE	
EWCE 105, CHEM-104, EWCE-331	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
This is the practical course on environmental engineering where students will be trained and practiced on various water and wastewater sampling and testing methods. Experience gained from this course will be used in later semesters and also in professional life.	
OBJECTIVE	
1. To impart knowledge to determine and analyze different parameters and substances in water. 2. To make the students efficient in performing different environmental experiments to satisfy specific needs and interpret the findings. 3. To introduce the students with standard procedure, how the test of water samples is conducted according to the standard code.	
COURSE CONTENT	
Water and wastewater sampling techniques, sample preservation, physical, chemical and biological tests of water and wastewater, breakpoint chlorination, alum coagulation sampling and laboratory analysis of air, particulate matter, sampling and laboratory analysis of soil and solid waste, sampling and laboratory analysis of noise.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Ability to use sophisticated instruments to analyze water quality parameters with their standard test protocol in terms of Engineering practice.					√							
2	CO2: Ability to conduct experiments to analyze the water quality parameters against their standards and also to interpret data in order to ensure safe water supply requirements to protect public health and				√								

	environment.												

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to use sophisticated instruments to analyze water quality parameters with their standard test protocol in terms of Engineering practice.	5	C3	1	-	6	Quiz, Report/Viva
CO2	Ability to conduct experiments to analyze the water quality parameters against their standards and also to interpret data in order to ensure safe water supply requirements to protect public health and Environment.	4	C4	1	-	4	Quiz, Report/Viva

Level of Bloom's Taxonomy:

C1 - Remember, C2 - Understand, C3 - Apply, C4 - Analyze, C5 - Evaluate, C6 - Create

(CP – Complex Problems, CA – Complex Activities, KP – Knowledge Profile, T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R – Report, F – Final Exam, Viva - V)

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning a) Lecture (1 hours/week x 10 weeks) b) Experiment (1 hr/week X10 weeks) c) Data analysis and calculation (0.75 hr/week X 10 weeks)	 10 10 7.5
Guided Learning a) Report Writing (2 hours/week x 10 weeks)	20
Independent Learning • Preparation for tests and examination	07
Assessment a) Quiz b) Viva c) Class Performance (0.25 hr/week X 10 weeks)	 02 01 2.5
Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**

1	01	Introduction, units of measurements, sampling procedure	Report/ Mid Quiz
	02	Determination of pH of water	
	03	Determination Color of water	
2	04	Determination Turbidity of water	
	05	Determination TS, TDS, TSS of water	
3	06	Determination of CO_2	
	07	Determination of Alkalinity of water	
4	08	Determination of Hardness of water	
5	09	Determination of Chloride of Water	
	10	Determination of Total Iron of Water	
6	06	Mid Quiz	
7	11	Determination of Biochemical Oxygen Demand (BOD5)	Report/ Final Quiz
	12	Determination of Chemical Oxygen Demand (COD)	
8	13	Alum Coagulation	
9	14	Break Point Chlorination	
10	15	Determination of Total and Fecal Coliform of water	
11	16	Determination of Arsenic contamination of water	
12	17	Noise survey, data collection and laboratory analysis	
13	18	Air quality survey, data collection and laboratory analysis	
14	14	Final Quiz	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Class Assessment, Report)	30%	CO1, CO2	C3, C4
Quiz	70%	CO1, CO2	C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. A Textbook of Water Supply Engineering by – M.A. Aziz
2. Water Supply and Sanitation by – Ahmed and Rahman
3. Laboratory Manual

COURSE INFORMATION	
Course Code: EWCE 333	Credit Hour: 4.0
Course Title: Waste Water Engineering and Sanitation	Contact Hour: 4.0
PRE-REQUISITE	
CHEM 103, EWCE-261 (Fluid Mechanics), EWCE-331 (Water Supply Engineering)	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
In this course students will be presented with basic knowledge on wastewater source, design of sewage collection and treatment system, microbiology, characteristics, treatment and management of sewage sludge, sanitation system, and plumbing system. Knowledge gained from this course will be used in later semesters and also in professional life.	
OBJECTIVE	
1. To gain knowledge on the basics of waste water technology and sanitation options. 2. To become skilled at the design and construction of sanitary sewer, storm sewer, waste water treatment plant. 3. To learn about the details of sewage treatment methods and design of treatment units. 4. To understand the importance of sludge management and learn about the sludge treatment facilities. 5. To be acquainted with the sanitation technologies, especially practiced in low- income and developing countries around the world and learn to design those facilities knowing the appropriateness of technologies suitable to specific site condition.	
COURSE CONTENT	
Introduction to wastewater engineering, estimation and collection of wastewater, hydraulics of sewer, design, construction and maintenance of sanitary sewer and storm drainage system, sewer appurtenances, plumbing system for building. Microbiology of sewage and waste water, wastewater characteristics, wastewater treatment methods and disposal, treatment and disposal of industrial effluents, sludge treatment and disposal. Water supply, sanitation and health, sanitation for low-income communities, design and construction of septic tanks, soak wells and subsurface drain fields, sustainability of water and sanitation services.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Ability to estimate the waste water, solid waste and human waste generation rate and assess the requirements for preferred sanitation system in urban as well as rural areas.	√											
2	Ability to identify likely Environmental impacts/risks prior to start construction of any development projects so that adverse environmental impacts could be minimized timely and effectively.							√					
3	Ability to apply Engineering perception to construct sewerage networks and building plumbing in terms of economic, public health, environment and sustainability.							√					
4	Ability to analyze waste-water data and related treatment options			√									

	to design efficient and cost effective ETP and STP with appropriate consideration for public health and safety.												

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP (WP)	CA (EA)	KP (WK)	Assessment Methods
CO1	Ability to estimate the waste water, solid waste and human waste generation rate and assess the requirements for preferred sanitation system in urban as well as rural areas.	1	C2	1	–	3	Class Test, Mid-term, Final Exam
CO2	Ability to identify likely Environmental Impacts/risks prior to start construction of any development projects so that adverse environmental impacts could be minimized timely and effectively.	7	C2	1	–	3	Class Test, Mid-term, Final Exam
CO3	Ability to Apply Engineering perception to construct sewerage networks and building plumbing in terms of economic, public health, environment, and sustainability.	7	C3	2	1	4,7	Class Test, Mid-term, Group Assignment Final Exam
CO4	Ability to analyze waste-water data and related treatment options to design efficient and cost effective ETP and STP with appropriate consideration for public health and safety.	3	C4	3	4	5	Class Test, Mid-term, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (4 hours/week × 14 weeks)	56
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home	12 22 65

Preparation for final examination	
Formal Assessment • Continuous Assessment Final Examination	 2 3
Total	160

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	1	Importance of Waste water Engg. Introduction of water supply and waste water production	
	2	Significance of waste water, where does it come? Generation of waste water	
	3	Water, sanitation and health, Objectives of environmental sanitation, Classification of Wastes and Sanitation Systems	
	4	Functions of sanitation system, Types of sanitation system, Appropriateness of sanitation system, Criteria for a good sanitation system	Class Test
2	5	Estimation of waste water flow, discharge computation	
	6	Per capita waste water generation, Daily discharge, seasonal variation, peak discharge	
	7	On-site sanitation systems for rural & low-income urban communities Simple pit technology – design considerations and design	
	8	Two pit latrine systems – design considerations and design	
3	9	Characteristics of waste water, dissolved solids, suspended solids	Class Test
	10	Nutrients in waste water and oxygen demand	
	11	Ventilated Improved Pit (VIP) Latrine, Reed Odorless Earth Closet (ROEC)	
	12	Pour-flash sanitation technologies – design considerations and design	
4	13	BOD, COD, DO	
	14	Environmental problems of untreated waste water	
	15	Pour-flash sanitation technologies – design considerations and design	
	16	Septic tank – design considerations	
5	17	Eutrophication, turbidity and water pollution	Group Assignment
	18	Sewer, Sewerage and sewage, Collection of waste water, combined system and separate system	
	19	Soak pit design	
	20	Disposal of septic tank effluent	
6	21	Sewer hydraulics, Manning's equations, curved sewers	
	22	Derivation of Partial flow equations, hydraulic element diagrams	
	23	Small Bore Sewerage (SBS) system	

		Changes in design criteria for SBS compared to Conventional Sewerage System	
	24	Simplified/ shallow sewerage system, Design principles and design	
7	25	Basic considerations of Sanitary sewer and storm sewer design	Mid-Term Exam
	26	Example of sanitary sewer design of a community	
	27	Ecological sanitation technologies	
	28	Composition and types of sewage, Physical, chemical and biological characteristics of sewage, Environmental significance of contaminants	
8	29	Sulfide generation, sewer inspection, construction and maintenance of sewers	
	30	Sewer appurtenances, manhole, Sewer test	
	31	Sewage treatment – purpose, phases and unit operations, Preliminary treatment methods – Screening, cutting screen or comminutors and grit chambers	
	32	Preliminary treatment methods – Skimming tank, pre-aeration, and flow equalization	
9	33	Importance, history and development of plumbing system	
	34	Design of plumbing system for an apartment	
	35	Primary treatment methods – Sedimentation, septic tank (review)	
	36	Primary treatment methods – Imhoff tank, dissolved air flotation	
10	37	Secondary treatment – purpose, biological treatment mechanism Important organisms involved in biological treatment	Class Test
	38	Role of bacteria in sewage treatment	
	39	Bacterial growth pattern in biological treatment	
	40	Relation between Food/Microorganism (F/M) ratio and biomass settling characteristics	
11	41	Types of biological treatment process, Activated sludge process Significance of F/M ratio in activated sludge process	
	42	Trickling Filter process – mechanisms and biological processes	
	43	Advantages, disadvantages, influencing factors in trickling filter process	
	44	Design of trickling filter	
12	45	Sustainability of water and sanitation services	
	46	Participatory development approach in water and sanitation sector	
	47	Waste stabilization ponds – process involved, advantages, disadvantages, Types of stabilization ponds	
	48	Anaerobic pond, facultative pond and maturation ponds, Design preliminaries for	

		waste stabilization ponds	
13	49	Community management of water and sanitation services; introduction to environment	Class Test
	50	Introduction of food sanitation	
	51	Design of waste stabilization ponds	
	52	Effluent disposal methods	
14	53	E-waste	
	54	Env Risk Assessment	
	55	Sludge – types, characteristics, Collection of sludge	
	56	Importance of sludge management, Sludge treatment and disposal methods	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3
Final Exam	60%	CO3, CO4	C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Environmental Engineering – Howard S. Peavy, Donald R. Rowe.
2. EWCE 333 Handouts and Class Lectures.
3. Water Supply, waste disposal and Sanitary Engineering – AK Chatterjee.
4. Water Supply and Sanitation – M Feroze Ahmed and MM Rahman.
5. Environmental Sanitation, Wastewater Treatment and Disposal – Tanveer Ferdous Saeed, Abdullah Al-Muyeed, Tanvir Ahmed.
6. Wastewater Engineering- Metcalf and Eddy.
7. Water Supply and Sewerage- Terence J. McGhee.

COURSE INFORMATION

Course Code: EWCE 341	Credit Hour: 3.0
Course Title: Geotechnical Engineering-I: Principle and Practices of Soil Mechanics	Contact Hour: 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This is the fundamental course on geotechnical engineering where students will be imparted with basic knowledge on types and identification of soils, soil properties and theories on soil mechanics. Student will be further exposed to soil parameters which will be helpful at later stages in the design of different soil related structures in their professional carriers.

OBJECTIVE

1. To gain insight on the basics of soil types, different ground formations/soil profiles and soil properties.
2. To understand the basic theories of soil mechanics and their practical applicability

COURSE CONTENT

Scope of Geotechnical Engineering: Soil Mechanics and foundation engineering, formation, type and identification of soils, soil composition, soil structure and fabric, weight-volume ratio, index properties of soils, engineering classification of soils, soil compaction, principles of total and effective stresses, stress distribution within the soil mass due external loadings, permeability and seepage, stress-strain-strength characteristics of soils, compressibility and settlement behavior of soils, difficult soils.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Able to comprehend the physical and index properties of soils and their uses in engineering classifications/practices.	√											
2	CO2: Able to estimate the distribution of stresses within the soil mass due to overburden, pore water and external loading.		√										
3	CO3: Able to analyze the failure of soil mass considering stress, strain and strength characteristics, compressibility of soil and the effect of overburden and surface loading on earth retaining and bearing structures.			√									
4	CO4: Able to evaluate the performance of soils due to difficult soils and consolidation processes.				√								

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to comprehend the physical and index	1	C2, C3	-	1	1,5	Class Test, Final Exam

	properties of soils and their uses in engineering classifications/practices.						
CO2	Able to estimate the distribution of stresses within the soil mass due to overburden, pore water and external loading.	2	C2, C4	-	1	1,5	Class Test, Mid-term, Final Exam
CO3	Able to analyze the failure of soil mass considering stress, strain and strength characteristics, compressibility of soil and the effect of overburden and surface loading on earth retaining and bearing structures	3	C2, C5	-	1	1,6	Assignment, Class Test, Final Exam
CO4	Able to evaluate the performance of soils due to difficult soils and consolidation processes.	4	C2, C4	-	1	1,6	Class Test, Final Exam

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA=
Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile
*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture (3 hours/week × 14 weeks)	42
Guided Learning Tutorial/ Assignments (2 hours/week × 6 weeks)	12
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	11 18 32
Formal Assessment a) Continuous Assessment b) Final Examination	2 3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Introduction	
	02	Scope of Geotechnical Engineering: Soil Mechanics and foundation engineering	
	03	Formation, type and identification of soils	
2	04	Formation, type and identification of soils(cont.)	CT 1

	05	Soil composition	
	06	Soil structure and fabric	Mid Term Exam
3	07	Soil particle size	
	08	Specific gravity	
	09	Particle size distribution curve	
4	10	Weight-Volume Relationship	
	11	Weight-Volume Relationship (cont.)	
	12	Weight-Volume Relationship (cont.)	
5	13	Index properties of soils	
	14	Engineering classification of soils	
	15	Engineering classification of soils (cont.)	
6	16	Soil compaction	
	17	Soil compaction (cont.)	
	18	Principles of total and effective stresses	
7	19	Principles of total and effective stresses (cont.)	
	20	Principles of total and effective stresses (cont.)	
	21	Stress distribution within the soil mass due to external loadings	
8	22	Seepage	
	23	Seepage (cont.)	CT 2
	24	Seepage (cont.)	
9	25	Permeability	
	26	Permeability (cont.)	
	27	Permeability (cont.)	
10	28	Stress-strain-strength characteristics of soils	
	29	Stress-strain-strength characteristics of soils (cont.)	
	30	Stress-strain-strength characteristics of soils (cont.)	
11	31	Shear strength of soil	
	32	Shear strength of soil (cont.)	
	33	Shear strength of soil (cont.)	
12	34	Lateral earth pressure	
	35	Lateral earth pressure (cont.)	CT 3
	36	Lateral earth pressure (cont.)	
13	37	Compressibility of soils	
	38	Compressibility of soils (cont.)	
	39	Compressibility of soils (cont.)	
14	40	Soil settlement	
	41	Soil settlement (cont.)	
	42	Review and problem solving	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO4	
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C3, C4, C5
Total Marks	100%		

REFERENCE BOOKS

1. Foundation Engineering -R.B. Peck, W.E. Hanson and T.H. Thornbur.
2. Introduction to Geotechnical Engineering - B.M. Das.
3. "Geotechnical Engineering, Principles and Practices", by Donald P. Coduto.

COURSE INFORMATION	
Course Code: EWCE 342	Credit Hour: 1.5
Course Title: Geotechnical Engineering Sessional	Contact Hour: 3.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
In this sessional course students will be given the basic knowledge on different typesof soil investigation equipment and techniques for both laboratory and field tests ofsoil samples. This knowledge will be will be useful in later semesters in performing thesis and project work, and also in professional life.	
OBJECTIVE	
1. To gain knowledge on the basics of soil investigation techniques. 2. To determine various properties of soil such as index properties, compressibility, and existing pressure in soil, strain-stresscharacteristics using standard equipment. 3. To analyze the performance of different soils under compaction, consolidation, seepage etc.	
COURSE CONTENT	
Field identification tests of soils, Grain size analysis by sieve and hydrometer, Specific gravity test, Atterberg limits test, Permeability tests, Unconfined compression test, Compaction test, Relative density test, Direct shear tests, Consolidation tests	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Ability to **determine** various properties of soil such as index properties, compressibility, and existing pressure in soil, strain-stress characteristics using standard equipment.	√											
2	Ability to **analyze** the performance of different soils under compaction,consolidation, seepage etc.		√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to **determine** various properties of soil such as index properties, compressibility, and existing pressure in soil, strain-stress characteristics using standard equipment.	1	C1, C4	1	–	1,3	Class Assessment, Lab Report, Mid Quiz, Final Quiz, Viva
CO2	Ability to **analyze** the performance of different soils under compaction,	2	C4	1	–	3,4,5	Class Assessment, Lab Report,

	consolidation, seepage etc.						Mid Quiz, Final Quiz, Viva

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture (3 hours/week × 12 weeks)	36
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	10 5 4
Formal Assessment • Continuous Assessment • Final Examination	2 3
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	1	Introduction	Class Assessment, Lab Report
2	2	Field identification tests of soils	
3	3	Grain size analysis of soil by sieve and hydrometer	
4	4	Specific gravity test of soil	
5	5	Atterberg limits test	
6	6	Relative density test	
7		Mid Quiz + Viva	Quiz, Viva
8	7	Constant head and falling head permeability tests	Class Assessment, Lab Report
9	8	Unconfined compression test	
10	9	Compaction test (standard and modified)	
11	10	Direct shear tests	
12	11	Consolidation test (one dimensional)	

13	12	Consolidation test (one dimensional)	
14		Final Quiz + Viva	Quiz, Viva

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assessments/ Lab reports/ Active Class Participation)	40%	CO1, CO2	C1, C4
Quiz	60%	CO1, CO2	C1, C4
Total Marks	100%		

REFERENCE BOOKS

1. Geotechnical Engineering Laboratory Handout: MIST
2. Soil Mechanics Laboratory Manual – B.M. Das
3. ASTM Standards for Geotechnical Engineering
4. Engineering properties of soils and their measurement – J E Bowles
5. Manual of Soil Testing – K H Head

COURSE INFORMATION	
Course Code: EWCE 343	Credit Hour: 3.0
Course Title: Geotechnical Engineering-II: Foundation Engineering	Contact Hour: 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This course will help the students to get in-depth knowledge about sub-soil conditions and design, construction of different types of foundations which will be very helpful in their professional life.

OBJECTIVE

1. To become skilled in exploring subsoil condition and in determining the properties of underlying soil of a site.
2. To gain knowledge on the analysis, design and construction of footing, raft and pile foundations in various types of soil conditions.
3. To acquire knowledge on the analysis and design of natural and man-made soil slopes.

COURSE CONTENT

Types of foundations, bearing capacity of shallow and deep foundations, subsoil investigation techniques, settlement and distortion of foundations, design and construction of footings, rafts and piles, lateral earth pressures, slope stability analyses.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Able to explore the subsoil condition of a site and to determine the properties of foundation soils in order to design and construct proper types of foundation of any civil engineering structures.	√											
2	CO2: Able to evaluate the bearing capacity and settlement for the purpose of designing footing and raft foundations for a structure on various subsoil and loading conditions.			√									
3	CO3: Able to evaluate the bearing capacity and settlement for the purpose of designing single and group pile foundation for a structure in various types of subsoil and loading conditions.				√								
4	CO4: Able to analyze the performance of existing foundation and construct new footing, raft and pile foundation in various subsoil conditions.		√										
5	CO5: Able to analyze the stability of any soil slopes in order to determining proper and stable slopes on various subsoil and groundwater conditions.	√											

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to explore the subsoil condition of a site and to determine the properties of foundation soils in order to design and construct proper types of foundation of any civil engineering structures.	1	C1, C2	1,4	1	1,3	Class Test, Final Exam
CO2	Able to evaluate the bearing capacity and settlement for the purpose of designing footing and raft foundations for a structure on various subsoil and loading conditions.	3	C2, C3	1,4	2	3	Class Test, Mid-term, Final Exam
CO3	Able to evaluate the bearing capacity and settlement for the purpose of designing single and group pile foundation for a structure in various types of subsoil and loading conditions.	4	C5, C6	1,4	1	3	Assignment, Class Test, Final Exam
CO4	Able to analyze the performance of existing foundation and construct new footing, raft, and pile foundation in various subsoil conditions.	2	C5	1,4	1,2	1,6	Class Test, Final Exam
CO5	Able to analyze the stability of any soil slopes in order to determining proper and stable slopes on various subsoil and groundwater conditions.	1	C3	1,4	1,2	1,6	Assignment, Final Exam

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture (3 hours/week × 14 weeks)	42
Guided Learning Tutorial/ Assignments (2 hours/week × 6 weeks)	12
Self- Directed Learning • Non-face-to-face learning	11

• Revision of the previous lecture at home • Preparation for the final examination	18 32
Formal Assessment a) Continuous Assessment b) Final Examination	 2 3
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem-Based Method
COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Scope and aspects of foundation engineering.	
	02	Purpose and stages of subsoil investigation, Information required from a subsoil investigation, Planning of subsoil investigation, Cost of exploration, Number and location of boring, Depth of boring.	
	03	Types of shallow foundation, Failure mechanism of foundation soil under footing, General bearing capacity equations for shallow foundation, Bearing capacity factors and angle of internal friction of soil, Bearing capacity factors proposed by various authors.	
2	04	Types of boring: Auger boring, Hollow stem auger boring, Wash boring, Percussion boring, ODEX drilling.	CT 1
	05	Types of boring: Auger boring, Hollow stem auger boring, Wash boring, Percussion boring, ODEX drilling.	
	06	Bearing capacity of strip footing on cohesionless soil, Effect of footing shapes on bearing capacity.	Mid Term Exam
3	07	Determination of ground water table, Soil sampling techniques.	
	08	Penetration tests, Standard penetration test and SPT N-values, Corrections for SPT N-values, SPT and soil strength parameters.	
	09	Design charts for the design of footing on cohesionless soil.	
4	10	Types of soil samplers, Types of soil samples and their usages, Sample disturbance and its measurement, Rock quality designation.	
	11	Dynamic cone penetration test, Dutch cone-penetration (CPT), Cone and sleeve resistance.	
	12	Bearing capacity of footing on clay, Skempton's equation.	
5	13	CPT friction ratio and its relationship with soil types, use of piezocone in determining porewater pressure and water table, CPT-SPT relations.	
	14	Geophysical methods of subsoil investigation, Field vane shear test, Subsoil investigation report.	
	15	Effect of load eccentricity on bearing capacity Meyerhof concept of equivalent	

		footing width.	
6	16	Types of deep foundation, Classification and use of pile foundation.	
	17	Driven and bored piles, Friction and bearing piles, Analysis of skin friction and end bearing for driven piles in sand.	
	18	Bearing capacity of raft foundation, Factor of safety in bearing capacity.	
7	19	Critical depth concept for piles in cohesionless soil, Estimation of skin friction and end bearing using critical depth concept.	
	20	Computation of skin friction of driven piles in clay, α-method.	
	21	Construction problems of footing and raft foundation.	
8	22	Computation of skin friction of driven piles in clay, β-method, λ-method.	
	23	End bearing for piles in clay soil, Bearing capacity of group piles in sand and clay, Efficiency of pile group.	CT 2
	24	Computation of settlement of footing, Elastic settlement, immediate settlement and consolidation settlement.	
9	25	Effect of load eccentricity on group piles, Estimation of bearing capacity from SPT-value for piles in sand, clay and silty soil.	
	26	Pile driving formula, Uplift capacity of individual pile and group	
	27	Construction problems of driven piles.	
10	28	Negative skin friction and remedial measures. Bearing capacity of bored Piles.	
	29	Pile load test and interpretation of load test data.	
	30	Construction problems of bored piles, Methods of advancing holes.	
11	31	Introduction to stability of slopes, Analysis of infinite slopes of cohesionless, cohesive and c-φ soils.	
	32	Planner method of stability analysis of finite slopes, Culmann's analysis.	
	33	Properties of bentonite to be used in advancing boreholes for cast in situ piles, Limitations of bentonite method.	
12	34	Effect of submergence and seepage on stability of infinite slopes.	CT 3
	35	Different modes of circular finite slope failure, Mass method of stability of slopes.	
	36	Actions to be taken before concreting of bored piles, Concreting of bored piles, Reverse circulation method.	
13	37	Slices methods of stability of slopes, Ordinary method of slices,	
	38	Various methods of determining centre or locus of slip surface.	
	39	Ground Improvement Methods Soil	

		Stabilization and Preloading	
14	40	Simplified Bishop method of stability analysis	
	41	Taylor’s chart.in analyzing stability of slopes.	
	42	Ground Improvement Methods SCP and Stone Columns	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom’s Taxonomy
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C1, C2, C3
Final Exam	60%	CO1, CO2, CO3, CO4, CO5	C1, C2, C3, C5,C6
Total Marks	100%		

REFERENCE BOOKS

1. Foundation Engineering - R.B. Peck, W.E. Hanson and T.H. Thornburn
2. Principles of Foundation Engineering: SI Edition - B.M. Das
3. "Foundation Analysis and Design" by Joseph E. Bowles

COURSE INFORMATION	
Course Code: EWCE 351	Credit Hour: 4.0
Course Title: Transportation Engineering	Contact Hour: 4.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
In this course students will be introduced with basic knowledge on transportation modes and system, geometric design of high ways and traffic engineering. Student will be further exposed to intelligent transportation system and traffic impact assessment which will be useful in later semesters and also in professional life.	
OBJECTIVE	
1. To acquire knowledge on geometric design of highways. 2. To orient with road traffic systems including fundamentals of traffic engineering. 3. To understand basics of transport planning. 4. To get acquainted with Intelligent Transportation System (ITS) and Traffic Impact Assessment (TIA).	
COURSE CONTENT	
Transport planning, concepts, scope and hierarchy, process, goals and objectives. Socio-economic activities, land use-transport interaction, travel demand forecasting, Transportation system of Bangladesh. Geometrical design of highways, cross-section elements, curves and sight distances, Pavement types, materials, functions and design, Traffic engineering: fundamentals of traffic engineering, vehicle and traffic characteristics, traffic control devices and systems, Intelligent transportation system.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Explore the problems related to different geometric features of the highways including finding solutions to common challenges encountered.	√											
2	CO2: Forecast travel demands using contemporary methods for effective transportation planning.		√										
3	CO3: Plan and design two phase traffic signal, considering the rudiments of traffic engineering			√									
4	CO4: Illustrate various type of pavement, their components and material requirement	√											

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Explore the problems related to different geometric	P1	C1, C2	-	-	1,3	Class Test, Mid-term, Final Exam

	features of the highways including finding solutions to common challenges encountered.						
CO2	Forecast travel demands using contemporary methods for effective transportation planning.	P2	C2, C5	-	-	1,2,4	Assignment
CO3	Plan and design two phase traffic signal, considering the rudiments of traffic engineering	P3	C1, C3	-	-	5	Class Test, Mid-term, Final Exam
CO4	Illustrate various type of pavement, their components and material requirement	P1	C1, C4	-	-	1,3	Presentation

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile
*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (4 hours/week × 14 weeks)	56
Guided Learning Tutorial/ Assignments (3 hours/week × 6 weeks)	18
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	40 16 25
Formal Assessment a) Continuous Assessment b) Final Examination	2 3
Total	160

TEACHING METHODOLOGY

Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Introduction to traffic engineering	
	02	Road traffic system and its components	
	03	Traffic characteristics, vehicle characteristics and road user characteristics	
	04	Traffic characteristics, vehicle characteristics and road user characteristics	
2	05	Traffic survey and studies	
	06	Traffic volume studies	CT 1
	07	Traffic volume studies	
	08	Traffic speed studies	
3	09	Traffic speed studies	
	10	Traffic delay studies	
	11	Origin destination survey	

	12	Parking studies	
4	13	Traffic Control Devices, traffic signs and road markings	
	14	Traffic Control Devices, traffic signs and road markings	
	15	Traffic signal, types and design	
	16	Traffic signal, types and design	
5	17	Street lighting	
	18	Terminals – Bus and truck terminals	
	19	Elements of Geometric Design and design controls/criteria	
	20	Traffic Elements of highway design and LOS	
6	21	Functional classification of road and road hierarchy	
	22	Roadway cross-section and various elements of a road	
	23	Roadway cross-section and various elements of a road	Mid Term Exam
	24	Sight distances - Passing sight distance and stopping sight distance	
7	25	Sight distances - Passing sight distance and stopping sight distance	
	26	Sight distances - Passing sight distance and stopping sight distance	
	27	Super elevation and its characteristics	
	28	Intersection- Design principle, alignment, classification	
8	29	Intersection- Design principle, alignment, classification	
	30	Grade separation and interchange	CT 2
	31	Grade separation and interchange	
	32	Horizontal alignment and horizontal curves	
9	33	Vertical alignment and vertical curves	
	34	Basic elements of transportation planning and concepts	
	35	Basic elements of transportation planning and concepts	
	36	Scope of transportation planning, goals and objectives	
10	37	Classification of transportation system and functional classification of land transport system	
	38	Socio-economic activities and land use pattern-transport iteration	CT 3
	39	Data collection and travel surveys	
	40	Travel demand forecasting, trip generation, trip distribution and modal split	
11	41	Travel demand forecasting, trip generation, trip distribution and modal split	
	42	Travel demand forecasting, trip generation, trip distribution and modal split	
	43	Transportation system of Bangladesh	
	44	Pavement and its types	
12	45	Function of various pavements	CT 4
	46	Materials used in pavement construction	
	47	Aggregates - classification and properties	

	48	Aggregates - classification and properties	
13	49	Bituminous materials – classification and properties	
	50	Bituminous materials – classification and properties	
	51	Flexible pavement design	
	52	Flexible pavement design	
14	53	Rigid pavement design	
	54	Rigid pavement design	
	55	Intelligent transportation system	
	56	Intelligent transportation system	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C3, C4, C5
Final Exam	60%	CO1, CO2, CO3, CO4	C1, C2
Total Marks	100%		

REFERENCE BOOKS

1. Highway Engineering – Paul H. Wright, 6th Ed.
2. Transportation Engineering and Transport Planning – L.R. Kadiyali
3. Transportation Planning and Traffic Engineering – O'Flaherty

COURSE INFORMATION	
Course Code: EWCE 352	Credit Hour: 1.5
Course Title: Transportation Engineering Sessional	Contact Hour: 3.0
PRE-REQUISITE	
EWCE 351 (Transportation Engineering)	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
In this course the students will learn to perform mix design for highway materials and capacity analysis for road traffics, which they can apply professionally.	
OBJECTIVE	
1. To learn testing of highway materials and mix design 2. To perform analysis on road traffic capacity	
COURSE CONTENT	
Testing and quality control of highway materials, bituminous mix design, roadway traffic and capacity analysis.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Able to **determine** properties of aggregates and bitumen using standard methods	√											
2	CO2: Able to **identify** optimum bitumen content by Mix Design			√									
3	CO3: Able to **determine** properties of aggregates and bitumen using standard methods and road way capacity & traffic saturation flow.				√								

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to **determine** properties of aggregates and bitumen using standard methods	1	C2	1, 5	-	5	Viva/Quiz/Lab Report
CO2	Able to **identify** optimum bitumen content by Mix Design	3	C4	1, 5	-	5	Viva/Quiz/Lab Report
CO3	Able to **determine** properties of aggregates and bitumen using standard methods and road way capacity & traffic saturation flow.	4	C4	1, 3, 5	-	5, 6	Viva/Quiz/Lab Report
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom’s Taxonomy:						

	C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create
	(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)					

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture (3 hours/week × 12 weeks) • Practical/ Tutorial/ Studio	36
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	3 12 3
Formal Assessment a) Continuous Assessment b) Quiz and viva	3 3
Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Determination of aggregate impact value (AIV) Determination of aggregate crushing value (ACV)	Quiz Test, Reports, Class participation, Viva
2	02	Determination of ten percent fines value Determination of angularity number	
3	03	Determination of flakiness index Determination of elongation index	
4	04	Specific gravity of semi-solid bituminous materials	
5	05	Loss on heating of oil and asphaltic compounds	
6	06	Penetration of bituminous materials	
7	07	Softening point of bituminous materials	
8	08	Ductility of bituminous materials	
9	09	Flash and fire points of bituminous materials	
10	10	Determination of roadway capacity. Measuring saturation flow at traffic signals	
11	11	Standard test method for CBR of laboratory compacted soils	
12	12	Marshal method of mix design	
13	13	Final Quiz Test	
14	14	Viva	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Assignment/Test/ Mid Term/ Active Class Participation)	30%	CO1, CO2, CO3	C2
Quiz	60%	CO1, CO2	C2
Viva	10%	CO1, CO2, CO3	C4
Total Marks	100%		

REFERENCE BOOKS

1. Highway Engineering – Paul H. Wright, 6th Ed.
2. Transportation Engineering and Transport Planning – L.R. Kadiyali
3. Laboratory Manual

COURSE INFORMATION	
Course Code: EWCE 361	Credit Hour: 3.0
Course Title: Open Channel Hydraulics	Contact Hour: 3.0
PRE-REQUISITE	
EWCE 261 (Fluid Mechanics), EWCE 262 (Fluid Mechanics Sessional)	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
This course will be helpful for students to learn how to analyze different parameters of the Open channel flow and its classification; velocity and pressure distributions; energy equation, specific energy and transition problems; critical flow and control. In this course, students will also be introduced with the concept of uniform flow, Chezy and Manning equations, estimation of resistance coefficients and computation of uniform flow; momentum equation and specific momentum; hydraulic jump theory and analysis of gradually varied flow; computation of flow profiles; design of channels etc. which will be useful in designing open channel i.e. drainage channels or irrigation canals etc	
OBJECTIVE	
1. To learn the energy and momentum theories for flow through open channels. 2. To understand the Manning's and Chezy's equation in designing open channels. 3. To estimate energy dissipation due to hydraulic jumps in open flows. 4. To design different types of channels and compute numerically the flow profiles.	
COURSE CONTENT	
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, computation of flow profiles, design of channels.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: **Understand** the open channel flow, including the classifications of different types of open channels and **analyze** the key characteristics of various open channel geometries and their influence on flow behavior	√											
2	CO2: **Apply** principles of flow measurement to select and use appropriate devices in open channel flow and to design and implement control structures for managing and regulating flow in open channels.	√											

3	CO3: **Understand** the concept of uniform flow and apply Chezy and Manning equations to estimate resistance coefficients and proficiency in computing uniform flow, considering the hydraulic factors influencing channel design.	√											
4	CO4: **Analyze** gradually varied flow using the momentum equation and specific momentum concepts and **understand** hydraulic jump theory and its application in controlling and dissipating energy in open channel flow		√										
5	CO5: **Apply** knowledge of open channel flow to design efficient channels, considering factors such as velocity, bed materials, specific energy, and transition problems. Ability to compute flow profiles and design channels that meet specified engineering criteria			√									

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	**Understand** the open channel flow, including the classifications of different types of open channels and **analyze** the key characteristics of various open channel	1	C2	1	–	1	Pop Quiz, Final Exam

	geometries and their influence on flow behavior						
CO2	**Apply** principles of flow measurement to select and use appropriate devices in open channel flow and to design and implement control structures for managing and regulating flow in open channels.	1	C3	1	–	1	Class Test, Mid-Term, Final Exam
CO3	**Understand** the concept of uniform flow and apply Chezy and Manning equations to estimate resistance coefficients and proficiency in computing uniform flow, considering the hydraulic factors influencing channel design.	1	C2	1	–	1	Mid-Term, Final Exam
CO4	**Analyze** gradually varied flow using the momentum equation and specific momentum concepts and **understand** hydraulic jump theory and its application in controlling and dissipating	2	C2, C4	1	–	1	Class Test, Mid-Term, Final Exam

	energy in open channel flow						
CO5	**Apply** knowledge of open channel flow to design efficient channels, considering factors such as velocity, bed materials, specific energy, and transition problems. Ability to compute flow profiles and design channels that meet specified engineering criteria	3	C3	1	-	1,5	Class Test, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Self- Directed Learning ● Non-face-to-face learning ● Revision of the previous lecture at home ● Preparation for final examination	09 18 46
Formal Assessment ● Continuous Assessment ● Final Examination	02 03
Total	120
TEACHING METHODOLOGY	
Lecture and Discussion, Problem Based Method	

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	1	Basic concepts of Open Channel Flow	CT/ Assignment/ Final Exam
	2	Characteristics of open channel flow	
	3	Effect of gravity and viscosity on flow	
2	4	Velocity and pressure distribution	
	5	Correction factors for velocity and momentum	
	6	Continuity and Energy equation	
3	7	Concept of Specific energy, specific energy curve	
	8	Transition problem	
	9	Concept of Critical flow	
4	10	Theories related to critical flow	CT/ Assignment/ Final Exam
	11	Computation of critical depths: analytical method	
	12	Computation of critical depths: trial and error method	
5	13	Concept of uniform flow	
	14	Uniform flow formulas	
	15	Chezy's and Manning's equation	
6	16	Resistance coefficients	Mid Term/ Assignment/ Final Exam
	17	Computation of normal depth	
	18	Uniform flow for complex channels	
7	19	Hydraulic exponent for uniform flow computation	
	20	Computation of normal and critical slopes	
	21	Channel sections with composite roughness	
8	22	Compound Cross-sections	
	23	Principles of flow measurement and devices	
	24	Gradually Varied Flow (GVF): definition	
9	25	Dynamic equations of GVF, channel slopes	
	26	Flow profiles on Mild and Steep slopes	
	27	Flow profiles on Critical, Horizontal and Adverse slopes	
10	28	Draw simple profiles	
	29	Practice complex profiles	
	30	Calculation of critical and uniform depths	
11	31	Calculation of simple flow profiles	
	32	Description of Direct Step method	
	33	Numerical computation of flow profiles using direct step method	
12	34	Hydraulic Jump: definition, practical use, types etc	CT/ Assignment/ Final Exam
	35	Hydraulic Jump: derivation of different	

		theories	
	36	Hydraulic Jump: computation of jumps and losses of energies	
13	37	Design of Channels: basics, definition, design of simple channels	
	38	Design of best hydraulic sections	
	39	Design of erodible channels (theory)	
14	40	Design examples of erodible channels	
	41	Design of Alluvial channels: theory	
	42	Design examples of Alluvial channels	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO4	C2, C4
Final Exam	60%	CO2, CO3, CO5	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. Open Channel Hydraulics - V T Chow, Mc Graw Hill
2. Flow through open channels - K G Ranga Raju
3. Flow in open Channels - K Subramanyan
4. Open Channel Hydraulics - R H French

COURSE INFORMATION	
Course Code: EWCE 362	Credit Hour: 1.5
Course Title: Open Channel Hydraulics Sessional	Contact Hour: 3.0

PRE-REQUISITE

EWCE 261(Fluid Mechanics), EWCE 262(Fluid Mechanics Sessional), EWCE-361 (Open Channel Hydraulics)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course the students will learn to apply their theoretical knowledge on hydraulic properties of open channel in practical fields for designing open channel systems.

OBJECTIVE

1. To gain knowledge on the basics of open channel flow focusing critical, uniform, and gradually varied flow.
2. To devise energy and momentum theories for flow through open channels.

COURSE CONTENT

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. River modelling basic concepts.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to **understand** the state of flow while passing through open channels with velocity and discharge variation.	√											
2	CO2: Be able to **devise** the flow profiles and losses of energy when open channel flows passing through different hydraulic structures i.e. weir, sluice gate etc.		√										
3	CO3: Be able to **apply** the theories of energy and force on open channel flows.		√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **understand** the state of flow while passing through	1	C2	1,4	-	1, 3, 5	Report, Mid Term, Final Quiz

	open channels with velocity and discharge variation.						
CO2	Be able to **devise** the flowprofiles and losses of energy when open channel flows passing through different hydraulic structures i.e. weir, sluice gate etc.	2	C3	1,4	-	1, 3, 5	Report, Mid Term, Final Quiz
CO3	Be able to **apply** the theories of energy and force on open channel flows.	2	C3	1,4	-	1, 3, 5	Report, Final Quiz
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 10 weeks)	30
Guided Learning Report Writing (1 hour/week x 9 weeks)	01 09
Independent Learning Individual learning	10 08
Assessment Quiz +Viva	2
Total	60

TEACHING METHODOLOGY
Lecture, Laboratory Experiments, Class Assessment

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	1	Introduction to Open Channel flow and different devices to be used throughout this Course	Report, Assignment/Test
2	2	Determination of state of flow and critical depth in open channel flow	
3	3	Flow over Broad Crested Weir	
4	4	Flow Through a Venturi Flume	

5	5	Flow Through a Parshall Flume	
6	6	Mid Term Quiz	Mid Quiz
7	7	Flow Beneath a Sluice Gate	Report, Assignment/Test
8	8	Determination Discharge and Mean Velocity of an Open Channel	
9	9	Determination of Change in Water Level due to Raised Channel Bottom	
10	10	Development and Generalized Specific Energy and Specific Force Curves	
11	11	Study on Hydraulic Jump	
12	12	Final Quiz	Final Quiz
13	13	Viva	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Lab Report/Class Assessment/Assignments Class Participation Mid Term)	50%	CO1, CO2,CO3	C2, C3
Final Exam	50%	CO1, CO2, CO3	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. Lab Manual and Class Lectures
2. Open channel hydraulics - V T Chow
3. Flow in open channels - Subramanya

COURSE INFORMATION	
Course Code: EWCE 363	Credit Hour: 3.0
Course Title: Engineering Hydrology	Contact Hour: 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

Basic understanding of hydrologic cycle, hydrological parameters and the interrelationships acquired from this course will be helpful for later semesters and professional fields.

OBJECTIVE

1. To understand the basic principles of hydrology
2. To gain knowledge about hydrologic data and hydrologic processes
3. To get basic idea about flood routing and statistical methods

COURSE CONTENT

Hydrologic cycle, physics of air flow, precipitation, Stream flow, infiltration and soil moisture, evaporation and evapo-transpiration, hydrologic data acquisition, rainfall-runoff relationships, hydrograph analysis, flood routing and statistical Methods in hydrology.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Able to **describe** the basic concepts of hydrology, various process, measurement and estimation of hydrological components: precipitation, evaporation, infiltration, stream flow etc.	√	√										
2	CO2: Able to **analyze** rainfall-runoff relationship, hydrographs and apply various statistical methods for hydrological analysis	√	√										
3	CO3: Able to **compute** basic calculation on flood routing and other routing parameters.		√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to **describe** the basic concepts of hydrology, various process, measurement and estimation of hydrological components: precipitation, evaporation, infiltration, stream flow etc.	1, 2	C1, C2	–	–	1,2	Class Test, Mid-term, Final Exam
CO2	Able to **analyze** rainfall-runoff relationship, hydrographs and apply various statistical methods for hydrological analysis	1, 2	C2, C4	–	–	3	Class Test, Mid-term, Final Exam
CO3	Able to **compute** basic calculation on flood routing and other routing parameters	2	C3, C4	–	–	3	Class Test, Final Exam

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA=
Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge
Profile/ KP= Knowledge Profile
*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Guided Learning Tutorial/ Assignments (2 hours/week × 6 weeks)	12
Self- Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for the final examination	 11 18 32
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	120
TEACHING METHODOLOGY	

Lecture and Discussion, Problem-Based Method			
COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction: Hydrological Cycle, Catchment Area	CT 1
	02	Introduction: Water Budget Equation, Residence Time	
	03	Weather System: Temperature and Pressure Variation in the atmosphere,	
2	04	Weather System: Weather parameter estimation	
	05	Weather System: Precipitable water in the air column	
	06	Precipitation: Formation of precipitation, Forms of precipitation	
3	07	Precipitation: Measurement of precipitation, Computation of average rainfall	
	08	Precipitation: Analysis of Rainfall Data.	
	09	Precipitation: Presentation of Rainfall Data	
4	10	Evaporation: Evaporation process, Estimation of evaporation	
	11	Evaporation: Transpiration and Evapo-transpiration,	
	12	Evaporation: Estimation of Potential Evapo transpiration	
5	13	Infiltration: Infiltration and Infiltration Capacity, Horton‘s equation for Infiltration Capacity	Mid Term Exam
	14	Infiltration: Horton‘s equation for Infiltration Capacity, Infiltration Index	
	15	Infiltration: Infiltration Index	
6	16	Hydrograph: Storm Hydrograph and its component,	
	17	Hydrograph: Factors affecting flood/storm hydrograph	
	18	Hydrograph: Base flow separation technique for Measuring Direct Runoff Hydrograph(DRH)	
7	19	Hydrograph: Effective Rainfall, Effective Rainfall Hyetograph (ERH)	
	20	Hydrograph: Relationship between ERH and DRH	
	21	Unit Hydrograph: Unit Hydrograph and its characteristics	
8	22	Unit Hydrograph: Time invariance and Linear Response	CT 2
	23	Unit Hydrograph: Derivation of Unit Hydrograph	
	24	Unit Hydrograph: Synthetic Unit Hydrograph	
9	25	Runoff: Components of runoff, Stream characteristics,	
	26	Runoff: Yield of a river, Rainfall & Runoff correlation	
	27	Runoff: Flow-Duration curve, Drought: Occurrence	

10	28	Runoff: Drought: Occurrence, Classification and Management	
	29	Stream Flow Measurement: Stream, Stream Flow and its measurement, Stage of a river and its measurement	
	30	Stream Flow Measurement: Measurement of Discharge by Area-Velocity method	
11	31	Stream Flow Measurement: Shifting and Permanent Control, Stage (G)-Discharge (Q)Relationship	
	32	Stream Flow Measurement: Stage (G)-Discharge (Q) Relationship, Extrapolation of rating curve	
	33	Flood: Flood and Peak Flood, Estimating Magnitude of peak flood	CT 3
12	34	Flood: Estimating magnitude of peak flood: Rational Method	
	35	Flood: Flood frequency analysis for estimating Peak flood	
	36	Flood: Flood frequency analysis for estimating Peak flood	
13	37	Flood: Risk and safety factor	
	38	Flood routing and statistical methods	
	39	Flood routing and statistical methods	
14	40	Hydrologic Data Acquisition	
	41	Hydrologic Data Acquisition	
	42	Hydrologic Data Acquisition	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C3, C4
Final Exam	60%	CO1, CO2, CO3	C1, C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Engineering Hydrology– K. Subramanya.
2. Applied Hydrology (Int'l Edn1988)- Chow, Maidment and Mays, McGraw-Hill International Editions.
3. Elementary Hydrology, V.P. Singh, Prentice Hall, 1992

COURSE INFORMATION	
Course Code: GEPM 375	Credit Hour: 3.0
Course Title: Project Planning and Construction Management	Contact Hour: 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This course is to gain basic knowledge on project management, resource management, project planning and various tools of project management. It is designed to develop understanding to perform project scheduling, project appraisals, financial aspect of projects, and resource allocation by operation research technique which will be useful in in their professional life.

OBJECTIVE

1. To gain knowledge on basics of project management & organizations, conflict & risks management, resource management, inventory management, demand forecasting and construction site management.
2. To develop fundamental skills for understanding and evaluating a project specially based on BCR, NPV, IRR etc.
3. To impart knowledge to solve the project problems by linear programming and manage a project by Gantt chart & network techniques and project management software.

COURSE CONTENT

Project Planning: project planning and evaluation, Planning and scheduling, PERT, CPM, resource scheduling, Project management software, linear programming and application, feasibility reports. Construction Management: Principles of management, Construction management: principles, project organization, methods and practices, technology, management of materials and equipment, 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. Finance: Time value of money, cash flows, payback period, net present value, internal rate of return, fisher's rate of intersection, benefit-cost ratio, cost-benefit analysis case studies.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Able to explain the principles of project management & organizations, human resource management, inventory management, demand forecasting and construction site management.											√	
2	CO2: Able to plan a project schedule by Gantt charts, network techniques and project management software and execute allocation of resources by linear programming.					√							
3	CO3: Able to understand the financial aspects of projects and apprise a project based on BCR, NPV, IRR etc.											√	
4	CO4: Able to understand project												√

	risks, project conflicts, evaluation & management project risks and conflicts.											

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to explain the principles of project management & organizations, human resource management, inventory management, demand forecasting and construction site management.	11	C2	-	1,4	1,3	Assignment, Class Test , Mid-term, Final Exam
CO2	Able to plan a project schedule by Gantt charts, network techniques and project management software and execute allocation of resources by linear programming.	5	C2, C4	-	1,2	1,8	Class Test, Final Exam
CO3	Able to understand the financial aspects of projects and apprise a project based on BCR, NPV, IRR etc.	11	C5	-	1	1	Assignment, Class Test , Mid-term, Final Exam
CO4	Able to understand project risks, project conflicts, evaluation & management project risks and conflicts.	12	C2, C4	1, 2	1	1,7	Assignment, Class Test , Mid-term, Final Exam

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42

Guided Learning Tutorial/ Assignments (2 hours/week × 6 weeks)	12
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	11 18 32
Formal Assessment a) Continuous Assessment b) Final Examination	2 3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Definition and characteristics of a project	CT/ Assignment-1
	02	Principles of Project Management	
	03	Principles of Project Management	
2	04	Feasibility study, feasibility report	
	05	Introduction to Construction Planning and Management	
	06	Project Organization: Methods and Practices, Technology	
3	07	Project life, time value of money compounding and discounting formulas	
	08	Project Organization: Methods and Practices, Technology	
	09	Project Team	
4	10	PBP, NPB	CT/ Assignment-2
	11	Project Leadership	
	12	Motivation	
5	13	BCR, IRR	
	14	Project Communication	
	15	Management of Materials and Equipment	
6	16	Project planning, WBS, network technique	Mid Term/ Assignment-3
	17	Site Management	
	18	Contracts and Specifications	
7	19	CPM, Project Planning software	
	20	Illustrative example with CPM, Project Planning software	
	21	Inspection and Quality Control	
8	22	PERT	
	23	Illustrative example with PERT	
	24	Safety	
9	25	Crashing and network to find the optimum duration	
	26	Illustrative example for crashing a network	
	27	Economy	
10	28	Introduction to Linear Programing, formulation of objective function, constraint equations	
	29	Graphical solution of linear programming	
	30	Project Risk management	

11	31	Illustrative examples of graphical methods	
	32	Illustrative examples of graphical methods	
		Project Risk management	
12	34	Inventory management	CT/ Assignment-4
	35	EOQ	
	36	Conflict Management	
13	37	Demand Forecasting	
	38	Methods of Demand Forecasting	
	39	Psychology in Administration	
14	40	Construction safety, ethics, procurement	
	41	Human Factors in Management	
	42	Human Resource Management	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C4, C5
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C4, C5
Total Marks	100%		

REFERENCE BOOKS

1. Project Planning and Control by –Lester.
2. The Process of Management" by – William H. Newman.
3. Introduction to Operational Research by – Hiller &Liberman.
4. Project Management Techniques by – A.O. Awani.
5. Construction Planning, Equipment and Methods by – Peurifoy.
6. Material Management & Inventory Control by – A.K. Datta.
7. Project Management by – S. Chowdhury.

COURSE INFORMATION

Course Code: EWCE 400	Credit Hour:4.00
Course Title: Project and Thesis	Contact Hour: 8.00

PRE-REQUISITE

-

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This course will enable the students to identify real life problems, perform background studies, brainstorm, assess the problems, draw interpretations, and recommend solutions, which will be beneficial for their professional life.

OBJECTIVE

1. Understand the research process with the help of relevant literature review.
2. Work independently to solve a problem with a little help from supervisor.
3. Become a critical thinker with analytical skills.
4. Become ethical and socially responsible.
5. Become more competent in oral, written and communication/presentation.

6. Create a proper engineering project work as per engineering dissertation/ thesis format.

COURSE CONTENT

Experimental and theoretical investigation of various topics in environmental engineering and water resources engineering. Individual or group study of one or more topics from any of the above fields. The students will be required to submit a thesis/project report at the end of the work and present his/her work in front of a board consisting of faculty member(s).

COURSE INFORMATION

Course Code: EWCE 402	Credit Hour: 3.0
Course Title: Capstone Project	Contact Hour: 6.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This is an open-ended capstone design project encompassing several Civil, Environmental, Water Resources, and Coastal Engineering disciplines. Develop a preliminary design for a project; prepare a regular team report; design memos engineering drawing and presentation; and present findings during a seminar. Students will apply cross-disciplinary (Civil/Environmental/Water Resources/Coastal Engineering) theories, methodologies, and skills to assess the technical, environmental, and social feasibility of the project including design and cost estimation. Students will present their project and submit project reports at the end of the work.

OBJECTIVE

The objectives of this course are

- To provide the students of opportunity to apply the structure approach of problem solving, covered in previous Civil, environmental, water resources, and coastal engineering courses, to a specific design project
- To develop design presentation report writing, project management and complex problem-solving skill.

COURSE CONTENT

Planning, analysis, and design of an integrated Civil, environmental, water resources, and coastal engineering project with emphasis on environmental/water resources/coastal engineering specialization. Students shall work in teams to apply civil engineering theories, methodologies, and skills to assess the technical, environmental, and social feasibility of the project including design and cost estimation. Students will analyze a wide range of technical engineering and other issues that arise in the real-life scenario. Students shall engage their diverse civil engineering and cross disciplinary knowledge to prepare final project reports, professional drawings and engage with industry mentors.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	**CO1:** *apply* the techniques, skills and modern engineering tools necessary for engineering practice					√							
2	**CO2**: *demonstrate* teamwork									√			

	ability to work collaboratively with fellow team members and end users												
3	**CO3:** *evaluate* alternative approaches to identify best solutions considering economic, environmental, social, ethical, health and safety, constructability, and sustainability aspects						√	√					
4	**CO4:** *comprehend* and *demonstrate* professional and ethical responsibility								√				
5	**CO5:** integrate previous knowledge and experience to enhance life- long learning abilities for their future personal and professional pursuits												√
6	**CO6:** *apply* knowledge for effective project management to ensureefficient use of time, financial resources, and other materialsresources.											√	
7	**CO7:** *communicate* the design and outcomes of the project in educational and professional settings										√		

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Apply the techniques, skills and modern engineering tools necessary for engineering practice	5	C3	1,2,7	1,3	6	Project Report Submission, Presentation
CO2	*Demonstrate* teamwork abilityto work collaboratively with fellow team members and end users	9	C3	-	2	7	Project Report Submission, Presentation
CO3	*Evaluate* alternative approaches to identify best	6,7	C6	1,2,3,6	1,2,3	7	Project Report Submission, Presentation

	solutions considering economic, environmental, social, ethical,health and safety, constructability, and sustainability aspects						
CO4	*Comprehend* and *demonstrate* professional and ethical responsibility	8	C3	4	-	7	Project Report Submission, Presentation
CO5	Integrate previous knowledge and experience to enhance life- long learning abilities for their future personal and professional pursuits	12	C5	1,6	4	-	Project Report Submission, Presentation
CO6	*Apply* knowledge for effective project management to ensureefficient use of time, financial resources, and other materialsresources.	11	C3	1,2,4	2,4	-	Project Report Submission, Presentation
CO7	*Communicate* the design andoutcomes of the project in educational and professional settings	10	C5		-	-	Project Report Submission, Presentation
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – AnalyzeEvaluate C5 - Create C6 – (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

COURSE INFORMATION	
Course Code: EWCE 411	Credit Hour: 3.0
Course Title: Structural Analysis II	Contact Hour: 3.0

PRE-REQUISITE

EWCE 101 (Analytical Mechanics) , EWCE 211 (Mechanics of Solids I), EWCE 213 (Structural Analysis I)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This is the second course on structural analysis. In this course, students will learn to analyze various structural components of indeterminate subjected to static and moving loads. Analysis techniques learnt here will be useful in later courses where students will learn how to design different structural components.

OBJECTIVE

1. To gain knowledge on analyzing the statically indeterminate beams and frames by moment distribution, consistent deformation/ flexibility and stiffness methods.
2. To become skilled at developing algorithm using stiffness matrix.
3. To get acquainted with how commercial software works to solve multi degree of indeterminacy.
4. To gain knowledge on developing influence lines of statically indeterminate beams and frames.

COURSE CONTENT

Analysis of statically indeterminate beams and frames by moment distribution, consistent deformation/flexibility, and stiffness methods; algorithms for implementing direct stiffness method using computer; influence lines of statically indeterminate beams and frames.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to **analyze** statically indeterminate problems.		√										
2	CO2: Be able to **develop** algorithms by using direct stiffness method.		√										
3	CO3: Be able to **solve** influence lines for statically indeterminate structures.		√										
4	CO4: Be able to **develop** understanding of the basic principles of structural analysis.	√	√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **analyze** statically indeterminate problems.	2	C4	1	-	1, 3,4	Class Test , Mid-term, Final Exam
CO2	Be able to **develop** algorithms by using direct stiffness	2	C6	1,3	-	4,5	Mid-term, Final Exam

	method.						
CO3	Be able to **solve** influence lines for statically indeterminate structures.	2	C4	1	-	4, 5,6	Assignment/ Class Test , Final Exam
CO4	Be able to **develop** understanding of the basic principles of structural analysis.	1, 2	C2, C5	1,3	-	4,5	Assignment, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Guided Learning Tutorial/ Assignments (2 hours/week × 6 weeks)	12
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	 11 18 32
Formal Assessment a) Continuous Assessment b) Final Examination	 2 3
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Course overview & Fundamental principles and methods of structural analysis	
	02	Basic of moment distribution method	
	03	Moment distribution method - Beam	
2	04	Moment distribution method - Beam	
	05	Moment distribution method - Beam	CT 1
	06	Moment distribution method - Frame	Mid Term
3	07	Moment distribution method - Frame	
	08	Moment distribution method - Frame	
	09	Moment distribution method - Frame	
4	10	Moment distribution method - Frame	
	11	Moment distribution method - Frame	
	12	Basic of Stiffness method	
5	13	Stiffness method - Beam	

	14	Stiffness method - Beam	
	15	Stiffness method - Beam	
6	16	Stiffness method – Plane Grid	
	17	Stiffness method – Frame	
	18	Stiffness method – Frame	
7	19	Stiffness method – Frame	
	20	Stiffness method – Frame	
	21	Stiffness method – Frame	
8	22	Stiffness method – Frame	CT 2
	23	Stiffness method – Frame	
	24	Stiffness method – Truss	
9	25	Stiffness method – Truss	
	26	Direct stiffness method	
	27	Developing algorithm for multiple degree of freedom.	
10	28	Basic of flexibility method	
	29	Flexibility method - Beam	
	30	Flexibility method - Beam	
11	31	Flexibility method - Beam	
	32	Flexibility method - Frame	
	33	Flexibility method - Frame	
12	34	Flexibility method - Frame	CT 3
	35	Flexibility method - Frame	
	36	Flexibility method - Truss	
13	37	Flexibility method - Truss	
	38	Basics of Influence line	
	39	Influence line of indeterminate structures- Beam	
14	40	Influence line of indeterminate structures- Beam	
	41	Influence line of indeterminate structures- Frame	
	42	Influence line of indeterminate structures- Frame	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C4, C5, C6
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C4, C5, C6
Total Marks	100%		

REFERENCE BOOKS

1. Structural Analysis, R C. Hibbeler, Prentice Hall,8th Edition
2. Indeterminate Structural Analysis, C K Wang, McGraw-Hill International Edition
3. Matrix Analysis of Framed Structures, W. Weaver, Jr., James M. Gere, McGraw Hill, 2nd Edition.
4. Elementary Structural Analysis, Charles Head Norris, John Benson Wilbur and Senol Utku, McGraw Hill, 4th Edition.
5. Structural Analysis by Aslam Kassimali (4th Edition)

COURSE INFORMATION

Course Code: EWCE 431	Credit Hour: 3.0
Course Title: Environmental and Social Impact Assessment	Contact Hour: 3.0

PRE-REQUISITE

EWCE 105, EWCE 131, EWCE 331, EWCE 333

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course, the students will learn to perform EIA and ESIA for various development projects which will be helpful in their professional life.

OBJECTIVE

1. To learn the methodologies of EIA and ESIA for various development schemes/ projects.
2. To achieve workable knowledge on evaluating EIA and ESIA of national and international development projects.
3. To apprehend the importance of stakeholder participation and other social perspectives of development projects.

COURSE CONTENT

Introduction to ESIA, methodology of EIA, EIA of development schemes, economical evaluation of EIA, application of EIA, EIA for protection measures, Different EIA index calculation: human development and poverty index; poverty reduction strategies in Bangladesh and gender issue related to human development. Environmental laws and regulations.

Preparation of Environmental management and monitoring plan, Environmental Issues in Bangladesh, Public Participation in Environmental Decision and losses, socio-economic aspect of development project; land loss, land use; land ownership patterns; population displacement; resettlement and rehabilitation strategy, socio-economic survey, case studies. Legal aspects of EIA, case studies

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Identify the various socio-economic impacts of development projects; including the land acquisition and resettlement related key issues for large scale development projects emphasizing the Bangladesh context						√						
2	CO2: Prepare outlines of Environmental and Social Impact Assessment (ESIA) of various development projects.						√	√			√		
3	CO3: Understand the importance and means of local community participation and locally available resources in development projects						√	√					
4	CO4: Integrate tools for incorporating Client Centered Approach for design, planning, and implementing development projects						√	√					
5	CO5: Integrate SDGs goals, targets, indicators, various socio-						√	√					

	economic Development Indicators to evaluate the effects of various development projects												

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Identify the various socio-economic impacts of development projects; including the land acquisition and resettlement related key issues for large scale development projects emphasizing the Bangladesh context	6	C4	1,2,6	-	7	Class Test, Mid-term, Final Exam
CO2	Prepare outlines of Environmental and Social Impact Assessment (ESIA) of various development projects.	6,7,10	C4, C6	1, 2,3	-	7	Class Test, Mid-term, Final Exam
CO3	Understand the importance and means of local community participation and locally available resources in development projects	6,7	C2	1,6,7	-	7	Class Test, Mid-term, Group Assignment Final Exam
CO4	Integrate tools for incorporating Client Centered Approach for design, planning, and implementing development projects project	6,7	C4, C6	1,3,6	-	7	Class Test, Mid-term, Final Exam
CO5	Integrate SDGs goals, targets, indicators, various socio-economic Development Indicators to evaluate the effects of various development projects	6,7	C3, C5	1,3,5	-	7	Class Test, Mid-term, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at	24 11

home • Preparation for final examination	20
Formal Assessment • Continuous Assessment • Final Examination	20 3
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	1	Concept of Environment	
	2	Introduction to Environmental Management	
	3	Goals of Environmental Management	
2	4	Major Environmental Issues in Bangladesh	
	5	Formulation of Environmental Policy	
	6	Environmental Policy in Bangladesh	
3	7	History of Environmental Laws	Class Test
	8	Environmental Laws in Bangladesh Period	
	9	Assessing critically endangered zone	
4	10	Process of Environmental Clearance Certificate	
	11	Objectives of EIA	
	12	Focus Group Discussion	
5	13	Steps of EIA	Group Assignment
	14	Scope of EIA	
	15	Environmental Management Plan	
6	16	EIA Methodologies	
	17	Composition of EIA Team	
	18	Environmental Quality Standards	
7	19	Impact Chain Approach	Mid-Term Exam
	20	Purpose of Setting Standard and Limitations	
	21	Importance of EMP in EIA	
8	22	Project Cycle and EIA	
	23	Format of EMP	
	24	Typical content of EMP Report	
9	25	EIA in water resources and industrial projects, Different EIA index calculation, Environmental laws and regulations	
	26	Application of EIA, EIA for protection measures	
	27	EIA of draughts in dry season, rainy season, impact of flood, solid waste management etc	
10	28	Economic and social structure in an ESIA report population	Class Test
	29	Development and economic growth assessment	
	30	Introduction to socio-economic indicators	
11	31	Rehabilitation strategy during EMP	
	32	Productivity, land loss, land use and land ownership pattern assessment	
	33	Analysis of communication, commerce, industries and other economic benefits	
12	34	Analysis of inequalities in distribution of	

		benefits and losses	
	35	Social Survey	
	36	Economic and Financial analysis	
13	37	Gender issues in an ESIA report	Class Test
	38	Legal aspects of EIA	
	39	Case studies	
14	40	Example of EIA report	
	41	Example of EIA report	
	42	Review of procedure of EIA Report	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO3, CO4	C2, C3, C4, C5, C6
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C3, C4, C5, C6
Total Marks	100%		

REFERENCE BOOKS

1. Environmental Impact Assessment - Larry W. Canter, 2nd Ed. McGraw-Hill
2. Environmental Impact Assessment: A Guide to Best Professional Practices - Charles H. Eccleston, CRC Press.
3. Evaluating Environmental and Social Impact Assessment in Developing Countries - Salim Momtaz, S. M. Zobaidul Kabir Waltham, Mass, Elsevier, 2013.Methods of Environmental Impact assessment - Therivel, Riki, 1st Ed. UCL press.

COURSE INFORMATION	
Course Code: EWCE 432	Credit Hour: 1.5
Course Title: Environmental Engineering Design Sessional	Contact Hour: 3.0
PRE-REQUISITE	
EWCE 100, EWCE 261, EWCE 331, EWCE 333	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
In this course the students will learn to identify fresh water supply requirement, estimate the industrial, domestic and fire demands, waste water discharge, design water wells, water distribution networks, sewerage network, sanitary facilities, drainage network, septic tanks, waste water treatment plans, building plumbing system, which they will be able to apply in their professions.	
OBJECTIVE	
1. To impart knowledge to conceptual design and analyze different components of an industrial area. 2. To develop the student's efficiency in performing plumbing design, sewer system design, water distribution design for any building, residential/ industrial area.	
COURSE CONTENT	
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, sewer network design, household plumbing system design, design of water and wastewater treatment plants.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to predict the fresh water supply requirement, wastewater discharge, storm water flow and sanitation requirement in urban as well as rural areas.		√										
2	CO2: Be able to design and construct water wells, sanitary sewers, storm sewers, septic tanks.			√									
3	CO3: Be able to design and construct wastewater treatment plants and sewage treatment options.			√									
4	CO4: Be able to design house plumbing facilities efficiently			√									

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to predict the fresh water supply	2	C2	1	–	3	Mid Term Exam, Report, Viva

	requirement, wastewater discharge, storm water flow and sanitation requirement in urban and rural areas.						
CO2	Be able to design and construct water wells, sanitary sewer, storm sewer, septic tanks	3	C6	3	–	1,5,6	Mid Term Exam, Report, Viva
CO3	Be able to design and construct wastewater treatment plants and sewage treatment options	3	C6	3	–	1,5,6	Final Exam, Report, Viva
CO4	Be able to design house plumbing facilities efficiently	3	C6	3	–	1,5,6	Final Exam, Report, Viva
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 12 weeks)	36
Guided Learning Tutorial/ Assignments (1 hours/week × 08 weeks)	08
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	13
Formal Assessment a) Continuous Assessment b) Quiz and viva	3
Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method
COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Introduction	Report/ Mid Exam/ Viva
2	02	Layout of Industrial Village	
3	03	Preparation of Organograms	
4	04	Population Estimation of the Industrial Village	
5	05	Water Demand Calculation for of the Industrial Village	
6	06	Development of Water Source for the Industrial Village	
7	07	Mid Term Quiz + Viva	
8	08	Determination of Pump Capacity & Pumping Schedule	Report/ Final Exam/ Viva
9	09	Design of Water Distribution Network (Branch Network)	
10	10	Design of Water Distribution Network (Loop Network)	
11	11	Design of Sanitary Waste Water System: Sanitary Sewer Design	
12	12	Introduction to Plumbing System	
13	13	Design of Plumbing System of a 10 Storied Building	
14	14	Final Quiz + Viva	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Assignment/Test/Report/Active Class Participation)	30%	CO1, CO2, CO3, CO4	C2, C6
Quiz (Mid Term+ Final)	60%	CO1, CO2, CO3, CO4	C2, C6
Viva	10%	CO1, CO2, CO3, CO4	C2, C6
Total Marks	100%		

REFERENCE BOOKS

1. A Text Book of Water Supply Engineering - M. A. Aziz, 1st ed., Hafiz Book Center
2. Water Supply and Sanitation - M. Feroz Ahmed, Md. Mujibur Rahman, 1st ed., ITN- BUET.
3. Water and Environmental Engineering - M. Habibur Rahman, Abdullah Al-Muyeed, 1st ed., ITN-BUET.
4. Environmental Engineering - Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, International Edition, McGraw Hill Companies.
5. Environmental Sanitation, Wastewater Treatment and Disposal – Tanveer Ferdous Saeed, Abdullah Al-Muyeed, Tanvir Ahmed.
6. Introduction to Environmental Engineering – Gilbert M. Masters and Wendell P. Ela, 3rd ed., Prentice-Hall Inc.
7. Wastewater Engineering- Metcalf and Eddy.
8. Water Supply and Sewerage- Terence J. McGhee.

9.	Plumbing Practices – Syed Azizul Haq, Peng.
10.	Plumbing Installation and Design – L. V. Ripka, 4th ed.

COURSE INFORMATION	
Course Code: EWCE 433	Credit Hour: 3.0
Course Title: Solid and Hazardous Waste Management	Contact Hour: 3.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
The students will learn about the sources and integrated management of solid, hazardous and medical wastes. The course is a foundation for designing an efficient management system of all kinds of solid and hazardous wastes starting from collection to final disposal, keeping the environment free of nuisance and safe guar ding human health.	
OBJECTIVE	
1. To understand the sources and characteristics of solid and hazardous waste. 2. To develop innovative solutions for collection, storage, transfer, treatment and disposal options of different wastes generated in society. 3. Obtain experience in assessing different sustainable solutions for potential resource recovery from solid wastes. 4. To design an integrated waste management system for the community.	
COURSE CONTENT	
Solid Waste Management: sources and characterization of solid wastes, solid waste generation, onsite handling, storage, processing, collection, transfer and transport of SW, resources and energy recovery and recycling, treatment and disposal options of SW. Hazardous Waste Management: sources and characterization of hazardous wastes, types and generation of hazardous waste, hazardous waste management plant, methods of treatment and disposal for hazardous wastes. Healthcare waste management: categories and treatment methods of healthcare wastes. Integrated waste management, legal and financial aspects of waste management.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	**CO1:** Ability to understand the characterization of different kinds of solid and hazardous wastes and their treatment.	√											
2	**CO2**: Ability to analyze health and environmental issues related to solid and hazardous waste management.		√										
3	**CO3:** Ability to solve various steps in solid waste management reduction at source, collection techniques, materials and resource recovery/recycling, optimization of solid			√									

	waste transport, treatment and disposal techniques.												
4	**CO4:** Ability to minimize the impact of waste management solutions on society and the environment and demonstrate the knowledge of and need for sustainable engineering solution							√					

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to understand the characterization of different kinds of solid and hazardous wastes and their treatment.	1	C2	1	–	1	Assignment, Pop quiz, Final Exam
CO2	Ability to analyze health and environmental issues related to solid and hazardous waste management.	2	C3	1	–	6	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to solve various steps in solid waste management such as waste reduction at source, collection techniques, materials and resource recovery/recycling, optimization of solid waste transport, treatment and disposal techniques.	3	C4	1	–	4	Class Test, Mid-term, Pop quiz, Final Exam
CO4	Ability to minimize the impact of waste management solutions on society and the environment and demonstrate the knowledge of and need for sustainable engineering solution	7	C4	1,2	–	7	Class Test, Mid-term, Pop quiz, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create						

	(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Guided Learning Tutorial/ Assignments (2 hours/week × 6 weeks)	12
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	 32 8 20
Formal Assessment a) Continuous Assessment b) Final Examination	 3 3
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction to solid waste management, Types and composition of Solid Waste, Characteristics of Solid Waste	CT 1
	02	Characterization of hazardous waste	
	03	Exposure to hazardous waste, Effects of toxicity, Dose-Response relationships	
2	04	Solid waste generation, sources and characterization of solid wastes	
	05	Non carcinogens, assessment of non-carcinogenic risk, Carcinogens, testing for carcinogenicity, dose-response relationships for carcinogens	
	06	Hazardous waste management strategies, Volume reduction – process modification, segregation, reuse	
3	07	Functional Elements of Solid Waste Management System, Rationale Steps in Integrated Solid Waste Management	
	08	Toxicity reduction of hazardous waste – process modification, equipment modification, material substitution	
	09	Recycling and exchange of hazardous waste	
4	10	Generation, on-site handling and transfer of solid wastes	CT 2
	11	Treatment methods for hazardous waste, Physicochemical treatment processes	
	12	Biological treatment processes for hazardous waste	
5	13	Composting of solid waste	
	14	Stabilization and solidification of hazardous waste	

	15	Thermal treatment methods for hazardous waste	
6	16	Phases of chemical decomposition of solid waste	
	17	Disposal methods for hazardous waste	
	18	Characterization of healthcare waste (HCW); Factors affecting organic breakdown	
7	19	Integrated Solid Waste Management	Mid Term Exam
	20	Integrated Solid Waste Management	
	21	Healthcare waste (HCW) generation	
8	22	Types of landfills, methods of landfill	
	23	Landfill operation	
	24	The risk associated with healthcare waste (HCW)	
9	25	Pollution from Landfill	CT 3
	26	Landfill Design	
	27	Hazards from infectious waste, sharps, chemical waste, pharmaceutical waste, radioactive waste, Hazards from healthcare waste treatment methods	
10	28	Sanitary Landfill and Design	
	29	Decomposition of Solid Wastes in landfills	
	30	Public health impacts of HCW	
11	31	Ultimate Disposal of Solid Waste: Method	
	32	Resources and energy recovery and recycling	
	33	HCW management - Waste minimization, safe reuse, recycling and recovery	
12	34	Legal and financial aspects of waste management I	
	35	Legal and financial aspects of waste management I	
	36	HCW management - Segregation systems, waste containers, segregation standards, Collection from healthcare facilities,	
13	37	Interim storage in medical departments, Central storage inside healthcare facilities	
	38	Onsite and Offsite transport of healthcare waste	
	39	HCW treatment technologies I – thermal, chemical, and irradiation processes	
14	40	HCW treatment technologies II –biological and mechanical processes	
	41	Treatment for specific HCW categories – pharmaceuticals, chemicals and wastes containing heavy metals	
	42	Disposal methods for healthcare waste	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C3, C4
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Solid and Hazardous Waste Management - M. Habibur Rahman and Abdullah Al Muyeed ITN-BUET.
2. Environmental Engineering - Howard S. Peavy, Donald R. Rowe and George Tchobanoglous,

International Edition, McGraw Hill Companies.
3. Integrated solid waste management: engineering principles and management issues - Tchobanoglous, George, Theisen, Hilary, Uigil, Samuel. 1st Ed. McGraw Hill Book Company.
4. Hazardous Waste Management in Bangladesh – A Country Inventory - Department of Environment (DoE), Bangladesh.

COURSE INFORMATION	
Course Code: EWCE 434	Credit Hour: 1.5
Course Title: Environmental Modelling Sessional	Contact Hour: 3.0
PRE-REQUISITE	
EWCE-331 (Water Supply Engineering), EWCE-435 (Air Pollution and Control), EWCE-206 (GIS in Environmental and Water Resources Engineering)	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
In this course the student will learn to use models and advanced software to solve practical problems found in the surrounding environment, like water, air, soil, noise level, etc. which will help them to apply their knowledge in professional life.	
OBJECTIVE	
1. To learn the basics of water, air, and noise models. 2. To become skilled at designing and analyzing a water distribution network system. 3. To get acquainted with noise modeling software. 4. To be able to demonstrate air dispersion models and RS software.	
COURSE CONTENT	
Basic components and processes, and internal dynamics of a water supply system, Modeling concept, Overview of water distribution network, Different analysis methods i.e. distribution main design, sensitivity analysis etc. in steady-state or extended period simulation, Designing and analyzing of a water distribution network, Environmental Noise Modelling and its application using software, Basics of regulatory air dispersion modeling, Meteorological data processing, Overview and data input for air dispersion model, Puff, and plume models.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Ability to **understand** the role and nature of modelling environmental systems	√											
2	CO2: Have a clearer **understanding** of the challenges and decisions associated with model implementation and validation of model outputs	√											
3	CO3: Ability to **identify** a particular environmental problem and **apply** an appropriate modeling framework		√	√	√								

4	CO4: Ability to **analyze** results of environmental models and co-relate them with physical phenomena		√										

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to **understand** the role and nature of modelling environmental systems.	1	C2	-	-	1	Mid Term, Final Exam
CO2	have a clearer **understanding** of the challenges and decisions associated with model implementation and validation of model outputs	1	C2	-	-	1	Mid Term, Final Exam
CO3	Ability to **identify** a particular environmental problem and **apply** an appropriate modeling framework	2, 3, 5	C3	-	-	4,6	Assignment, Report, Mid Term, Final Exam
CO4	Ability to **analyze** results of environmental models and co-relate them with physical phenomena	5	C4	-	-	4,6	Assignment, Report, Mid Term, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: <u>C1- Remember</u> <u>C2- Understand</u> <u>C3- Apply</u> <u>C4- Analyze</u> <u>C5- Evaluate</u> <u>C6- Create</u> (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	24 10 --
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for Mid Quiz • Preparation for Final Quiz	12 3 4 4
Formal Assessment • Continuous Assessment	1

• Mid Quiz • Final Quiz	1 1
Total	60

TEACHING METHODOLOGY

Lectures, Software Demonstrations

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	1	•Basic Components and processes, and internal dynamics of a water supply system •Modeling concept, A quick overview of the features, processes, and data management steps in WaterGEMS	Assignment, Report, Test, Mid Quiz
2	2	Building a Network and Performing a Steady-State Analysis in WaterGEMS	
3	3	Demonstrations of extended period simulation	
4	4	Scenario management, Reporting results	
5	5	Automated fire flow analysis	
6	6	Water quality analysis	
7	7	Pressure dependent demands	
8	8	Mid Quiz	
9	9	Environmental Noise Modelling and its application I	Assignment, Report, Final Quiz
10	10	Environmental Noise Modelling and its application II	
11	11	Physics of Air Dispersion, Hands on Meteorological Data Analysis	
12	12	Refined Model introduction, overview and data input for AERMOD	
13	13	Coordinate systems and maps, Terrain processing, understanding puff and plume models	
14	14	Final Quiz	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Class Assessment/Report/ Assignment)	40%	CO1, CO2, CO3, CO4	C2, C3, C4
Mid Quiz+ Final Quiz	60%	CO1, CO2, CO3, CO4	C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. A Step-by-Step Guide to EPANET 2.0 Simulations – Robert Pitt, Shirley Clark
2. A Text Book of Water Supply Engineering - M. A. Aziz, 1st ed., Hafiz Book Center
3. WaterGEMS Quick Start Tutorial
4. SoundPLAN User's manual
5. AERMOD Quick Reference Guide – USEPA
6. AERMOD Tech Guide – Lakes Environmental

COURSE INFORMATION	
Course Code: EWCE 435	Credit Hour: 2.0
Course Title: Air Pollution and Control	Contact Hour: 2.0

PRE-REQUISITE

CHEM-103 (Fundamentals of Chemistry), EWCE-105 (Environmental Chemistry)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will learn about the causes of air pollution and measures for air pollution control, which will help them design air pollution abatement system in their professional life.

OBJECTIVE

1. To identify the causes of air pollution.
2. To design air quality monitoring systems.
3. To formulate an air pollution control and management system.

COURSE CONTENT

Formations of earth crusts and changes that occur on the earth's surface. Rocks and minerals: identification of rocks and minerals, common rock forming minerals, physical properties of minerals, mineraloids rocks, types of rocks, cycle of rock change, earthquake and seismicity of Bangladesh, geology of Bangladesh. Structural geology: faults, types of faults, fold and fold type, domes, basins, erosional process, quantitative analysis of erosional landforms. Fluvial processes in Geomorphology: channel development, channel widening, valley shape, stream terraces, alluvial flood plains, deltas and alluvial fans, fluvial deposits, coastal deposits, glacial deposits, lacustrine deposits, Aeolian deposit, river basin, channel morphology, channel patterns and the river basin, geology and geomorphology of rivers of Bangladesh.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: To assess the air quality scenario and impacts of air pollutants on human health and society							√					
2	CO2: To understand the principles of air quality monitoring and abatement systems			√									
3	CO3: To understand air pollution control regulations to ensure sustainable management of public health and safety		√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	To assess the air quality	7	C4	1,6		2	Class Test,

	scenario and impacts of air pollutants on human health and society						Final Exam
CO2	To understand the principles of air quality monitoring and abatement systems	2	C3	1,5		4	Class Test, Mid-term, Final Exam
CO3	To understand air pollution control regulations to ensure sustainable management of public health and safety	6	C2	1,5		1	Assignment, Class Test, Mid Term, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	28
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	5 12 30
Formal Assessment a) Continuous Assessment b) Final Examination	2 3
Total	80

TEACHING METHODOLOGY
Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction	CT 1
	02	Definition, components, and effects of air pollution	
2	03	Sources, classification, and effects of air pollutants	
	04	Air pollution regulations: Air quality standard & Emission standard	
3	05	Pollution Indices, Mathematical problems	
	06	Mathematical problems	
4	07	Formation, sources, and effects of criteria pollutants	Mid Exam

	08	Formation, sources, and effects of criteria pollutants (cont.)	
5	09	Formation, sources, and effects of criteria pollutants (cont.)	
	10	Air quality scenario in Bangladesh	
6	11	Air quality scenario in Bangladesh (cont.)	
	12	Atmospheric properties, Lapse rate and stability	
7	13	Atmospheric stability and plume behavior	
	14	Mathematical problems related to atmospheric stability	
	15	Atmospheric diffusion theories	CT 2
	16	Point source Gaussian plume model	
9	17	Mathematical problems related to point source Gaussian plume model	
	18	Mathematical problems related to point source Gaussian plume model (cont.)	
10	19	Line source Gaussian plume model	
	20	Mathematical problems related to line source Gaussian plume model	
11	21	Air pollution control: Natural process & Engineering process	CT 3
	22	Control measures for Industrial emission	
12	23	Control measures for Vehicular emission	
	24	Example problems and analysis	
13	25	Climate change pattern	
	26	Description on the responsible air pollutants	
14	27	Some overall mathematical problems	
	28	Review of the total syllabus	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C3, C4
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Air Pollution Control - C. David Cooper and F. C. Alley, 3rd Ed.
2. Environmental Pollution and Control - J. Jeffrey Peirce, Ruth F. Weiner and P. Aarne Vesilind, 4th Ed.
3. Fundamentals of Air Pollution - Daniel Vallero.

COURSE INFORMATION	
Course Code: EWCE 436	Credit Hour: 1.5
Course Title: Treatment Plant Design Sessional	Contact Hour: 3.0

PRE-REQUISITE
EWCE-331 (Water Supply Engineering), EWCE-333 (Wastewater Engineering and Sanitation)

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE
Students will learn about the processes in the treatment of surface water, ground water and wastewater. They will learn designing the treatment plants, which will be helpful in their professional life.

OBJECTIVE
• To learn about the treatment processes for surface and ground water to make it suitable for drinking water supply. • To learn about the wastewater treatment processes. • To learn the design basic and treatment schemes of the treatment plants.

COURSE CONTENT
Detail design of an effluent treatment plant (ETP) to mitigate the adverse effects of untreated waste such as garment, leather and other industrial activities.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to formulate the treatment processes specific to surface water, ground water and wastewater.		√										
2	CO2: Be able to design the materials and chemical dosing for treatment required in the treatment plants			√									

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to formulate the treatment processes specific to surface water, ground water and wastewater	2	C4	1,3	-	3,4	Report, Viva
CO2	Be able to design the materials and chemical dosing for treatment required in the treatment plants	3	C5	1,5	-	5	Assignment, Quiz

**Level of Bloom’s Taxonomy:*
C1 - Remember C2 - Understand C3 - Apply C4 - Analyze C5 - Evaluate C6 - Create

	(CP – Complex Problems, CA – Complex Activities, KP – Knowledge Profile, T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R – Report, F – Final Exam, Viva - V)

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning a) Lecture (1 hours/week x 10 weeks) b) Experiment (1 hr/week X10 weeks) c) Data analysis and calculation (0.75 hr/week X 10 weeks)	10 10 7.5
Guided Learning b) Report Writing (2 hours/week x 10 weeks)	20
Independent Learning • Preparation for tests and examination	07
Assessment a) Quiz b) Viva c) Class Performance (0.25 hr/week X 10 weeks)	02 01 2.5
Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction	Report/ Mid Term Exam
2	02	BOD Calculations	
3	03	Screen and Grit Chamber Design	
4	04	Primary Sedimentation Tank Design	
5	05	Waste Stabilization Pond Design	
6	06	Mid Quiz	
7	07	Activated Sludge Process Theory	Report/ Final Exam
8	8	Activated Sludge Process Design	
9	9	Aerated Lagoon Design	
10	10	Septic Tank Design	
11	11	Surface Water Treatment Theory	
12	12	Surface Water Treatment Design	
13	13	Sludge Handling	
14	14	Final Quiz	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Observation Report, Viva)	30%	CO1, CO2	C5, C4
Quiz	70%	CO1, CO2	C5, C4

Total Marks	100%		

REFERENCE BOOKS
1. An Applied Guide to Water and Effluent Treatment Plant Design – Sean Moran, 1st Edition, 2018, Elsevier 2. Water Treatment Plant Design – American Waste Water Association, 4th Ed. 2004, McGraw Hill Publications 3. Integrated design and Operation of water Treatment Facilities – Susumu Kawamura, 2nd Ed. 2000, John Wiley and Sons

COURSE INFORMATION	
Course Code: EWCE 437	Credit Hour: 3.0
Course Title: Industrial Waste and Wastewater Treatment	Contact Hour: 3.0
PRE-REQUISITE	
CHEM 103, EWCE-261 (Fluid Mechanics), EWCE-331 (Water Supply Engineering), EWCE-333 (Waste Water Engineering and Sanitation)	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
In this course students will be presented with basic knowledge on industrial wastewater source, characteristics, treatment and management of industrial wastewater and sludge, laws and regulations for wastewater disposal. Knowledge gained from this course will be used in later semesters and professional life.	
OBJECTIVE	
• To learn about the characteristics of various industrial wastes and waste waters. • To learn about the problems associated with poor management of industrial waste and wastewater. • To learn about the laws and regulations for industrial waste and wastewater treatment and disposal.	
COURSE CONTENT	
Overview of industrial wastewater and problems associated with it, Laws and regulations for industrial wastewater and waste treatment, Overview of waste reduction techniques in industries, waste problems of major industries and their methods of treatment and disposal - such as petroleum industries (gasoline kerosene treatment), textile industries, tannery, cement, fertilizer, paper and pulp, jute processing, dairy, drug and pharmaceutical, sugar, food and allied industry, Treatment and disposal of industrial waste sludge.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Be able to **understand** the industrial manufacturing process and generation of waste and wastewater.	√											
2	Be able to **assess** the adverse effect of waste and wastewater in terms of economic, public							√					

	health, environment and sustainability.												
3	Be able to **analyze** waste-water data and related treatment options to **design** efficient and cost effective ETP with appropriate consideration for public health and safety			√									

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to understand the industrial manufacturing process and generation of waste and wastewater.	1	C2	-	-	3	Class Test, Mid-term, Final Exam
CO2	Be able to **assess** the adverse effect of waste and wastewater in terms of economic, public health, environment and sustainability.	7	C2	1	-	1	Class Test, Mid-term, Final Exam
CO3	Be able to **analyze** waste-water data and related treatment options to **design** efficient and cost effective ETP with appropriate consideration for public health and safety	3	C4	5	2	5	Class Test, Mid-term, Group Assignment Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom’s Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 24 11 20
Formal Assessment • Continuous Assessment	 20

• Final Examination	3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	1	Introduction to Industrial Waste and Wastewater treatment	
	2	Waste water estimation	
	3	Collection and transportation of Industrial sewage	
2	4	Industrial Waste Treatment I	
	5	Characteristics of Industrial sewage	
	6	Treatment and problems associated with industrial water	
3	7	Industrial Waste Treatment II	Class Test
	8	Overview of waste reduction techniques in industries	
	9	Manufacturing Process: Pulp and Paper Industry	
4	10	Manufacturing Process: Tannery Industry	
	11	Pulp and Paper Industry waste	
	12	Pulp and Paper Industry waste treatment I	
5	13	Tannery Waste	Group Assignment
	14	Pulp and Paper Industry waste treatment II	
	15	Manufacturing Process: Dairy Industry	
6	16	Tannery Waste Treatment I	
	17	Dairy Industry waste	
	18	Dairy Industry waste treatment	
7	19	Tannery Waste Treatment II	Mid-Term Exam
	20	Manufacturing Process: Oil Refinery	
	21	Oil Refinery waste	
8	22	Manufacturing Process: Textile Mill Industry	
	23	Textile Mill Industry waste	
	24	Oil Refinery waste treatment	
9	25	Textile Mill Industry waste treatment I	
	26	Textile Mill Industry waste treatment II	
	27	Manufacturing Process: Petroleum Industry	
10	28	Manufacturing Process: Pharmaceutical Industry	Class Test
	29	Pharmaceutical Industry waste	
	30	Petroleum Industry waste	
11	31	Pharmaceutical Industry waste treatment I	
	32	Pharmaceutical Industry waste treatment II	
	33	Petroleum Industry waste treatment I	
12	34	Manufacturing Process: Sugar Mill Industry	
	35	Sugar Mill Industry waste I	
	36	Petroleum Industry waste treatment II	
13	37	Sugar Mill Industry waste treatment II	Class Test
	38	Sugar Mill Industry waste treatment III	
	39	Manufacturing Process: Corn Starch Industry	
14	40	Corn Starch Industry waste	

	41	Corn Starch Industry waste treatment I	
	42	Corn Starch Industry waste treatment II	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO3	C2
Final Exam	60%	CO1, CO2, CO3	C4
Total Marks	100%		

REFERENCE BOOKS

1. Industrial wastewater treatment – A D Patwardhan, New Delhi: PHI Learning Private Ltd.
2. Handbook of Advanced Industrial and Hazardous Wastes Treatment - Lawrence K. Wang, Yung-Tse Hung, Nazih K. Shammas, CRC Press.
3. Industrial Wastewater Treatment, Recycling and Reuse - Vivek Ranade and Vinay Bhandari, Butterworth Heinemann

Industrial Wastewater Treatment - Wun Jern Ng, Imperial College Press

COURSE INFORMATION

Course Code: EWCE 438	Credit Hour: 1.5
Course Title: Building Service Sessional	Contact Hour: 3.0

PRE-REQUISITE

EWCE-331 (Water Supply Engineering), EWCE-333 (Waste Water Engineering and Sanitation)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

Students will learn to design different services to be provided in a building, like water supply system, wastewater and storm drainage system, water storage system, rainwater harvesting system, which will be helpful in their professional life.

OBJECTIVE

a) To learn about the major facilities/ services required for better living in buildings, especially in high rise buildings.
b) To design the necessary building services - water supply system, waste water and storm drainage system and water storage system.
c) To design alternative water supply system – rain water harvesting.

COURSE CONTENT

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

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be proficient to analyze and design the water supply,		√	√									

	wastewater and storm water drainage system												
2	CO2: Be able to design underground and overhead water storage tanks			√									
3	CO3: Be able to design rain water harvesting system			√									

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be proficient to analyze and design the water supply, waste water and storm water drainage system	2,3	C4		3,5	3,4	Report, Viva, Quiz
CO2	Be able to design underground and overhead water storage tanks	3	C5		3	5	Report, Viva, Quiz
CO3	Be able to design rain water harvesting system	3	C5		3	5	Report, Viva, Quiz

**Level of Bloom's Taxonomy:*

C1 - Remember | C2 - Understand | C3 - Apply | C4 - Analyze | C5 - Evaluate | C6 - Create

(CP – Complex Problems, CA – Complex Activities, KP – Knowledge Profile, T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R – Report, F – Final Exam, Viva - V)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 12 weeks)	36
Guided Learning Tutorial/ Assignments (1 hours/week × 12 weeks)	12
Self- Directed Learning a. Non-face-to-face learning b. Revision of the previous lecture at home c. Preparation for final examination	1 2 3
Formal Assessment a. Continuous Assessment b. Final Examination/Quiz and Viva	2.5 2 1
Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Introduction to Plumbing design	Quiz, Report
2	02	Water supply (hot water and cold water) design of multi-storied buildings	
3	03	Water supply (hot water and cold water) design of multi-storied buildings (cont.)	
4	04	Sewerage design of multi-storied buildings	
5	05	Sewerage design of multi-storied buildings (cont.)	
6	06	Assessment (Viva)	
7	07	Assessment (Mid Quiz)	
8	08	Introduction to Rainwater Harvesting	
9	09	Planning and design of rainwater and ground water storage structures	
10	10	Planning and design of rainwater and ground water storage structures (cont.)	
11	11	Design of rainwater harvesting filters	
12	12	Maintenance and monitoring of rainwater harvesting system.	
13	13	Assessment (Viva)	
14	14	Assessment (Final Quiz)	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Assignment/Test/ Mid Term/ Active Class Participation)	30%	CO1, CO2, CO3	C4, C5
Quiz	70%	CO1, CO2, CO3	C4, C5
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Building Services Engineering – David V. Chadderton, 6th Ed.
2. Building Services Handbook – Roger Greeno, 7th Ed, Fred Hall

COURSE INFORMATION	
Course Code: EWCE 439	Credit Hour: 2.0
Course Title: Natural Resources and Renewable Energy	Contact Hour: 2.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
In this course students will learn about natural resources, renewable energy, energy efficiency which will be helpful in their professional life in designing energy efficient engineering solutions.	
OBJECTIVE	
• To understand the importance of natural resources conservation and management. • To learn about the use of energy in various emerging technologies. • To learn about the importance of using renewable energy.	
COURSE CONTENT	
Classification and sources, extraction, depletion, protection and management of natural resources. Overview, history, mainstream technologies, wind power, hydropower and hydroelectricity, solar energy, biomass and bio fuel, geothermal energy, commercialization, growth of renewable, economic trends, hydroelectricity, development of renewable energy and emerging technologies of renewable energy.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Able to **gain** knowledge about various natural resources.	√											
2	Able to **understand** the importance of using renewable energy.	√											
3	Able to **understand** and **apply** the concept of sustainable development in the use of energy in various emerging technologies.							√					

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to **gain** knowledge about various natural resources.	1	C2	1	–	1	Class Test, Mid-term, Final Exam
CO2	Able to **understand** the importance of using renewable energy.	1	C2	1	–	1	Class Test, Mid-term, Final Exam
CO3	Able to **understand** and **apply** the concept of sustainable	7	C3	1	–		Class Test, Mid-term,

	development in the use of energy in various emerging technologies.					6	Group Assignment Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	28
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home Preparation for final examination	5 12 30
Formal Assessment • Continuous Assessment • Final Examination	2 3
Total	80

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	1	Introduction to Natural Resources	
	2	Classification and sources of natural resources	
2	3	Extraction, depletion, protection and management of natural resources I	
	4	Extraction, depletion, protection and management of natural resources II	
3	5	Overview, history of mainstream technologies	Class Test
	6	Wind power	
4	7	Hydropower and hydroelectricity I	
	8	Hydropower and hydroelectricity II	
5	9	Solar energy I	Group Assignment
	10	Solar energy II	
6	11	Biomass and bio fuel I	
	12	Biomass and bio fuel II	
7	13	Geothermal energy I	Mid-Term Exam
	14	Geothermal energy II	
8	15	Commercialization and growth of renewable	

		energy	
	16	Economic trends	
9	17	Wind power development I	
	18	Wind power development II	
10	19	Photovoltaic development I	
	20	Photovoltaic development II	
11	21	Photovoltaic power stations I	
	22	Photovoltaic power stations II	
12	23	Bio fuel development I	
	24	Bio fuel development II	
13	25	Geothermal development I	Class Test
	26	Geothermal development II	
14	27	Emerging technologies of renewable energy I	
	28	Emerging technologies of renewable energy II	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2	C2
Final Exam	60%	CO1, CO2, CO3	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. Managing Our Natural Resources - William G. Camp, Thomas B. Daugherty, 4th Ed, Thomson Learning
2. Introduction to Renewable Energy - Vaughn C. Nelson, CRC Press
3. Renewable Energy - Bent Sorensen, 3rd Ed, Elsevier Inc.
4. Renewable Energy Systems: Advanced Conversion Technologies and Applications - Fang Lin Luo, Ye Hong, CRC Press
5. Sustainable Energy Solutions for Climate Change - Mark Diesendorf, Routledge, New York

COURSE INFORMATION

Course Code: GEEM 445	Credit Hour: 2.0
Course Title: Engineering Ethics and Professional Practices	Contact Hour: 2.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This is a professional field-oriented course where students will be given knowledge on projects, ethics in engineering professions, public procurements rules and regulations, and how to prepare contact documents and development project proposals.

OBJECTIVE

1. To have a clear idea about different aspects of a project and comprehend the basics of professional communication.
2. To understand the code of Ethics for engineers and other related issues in the engineering profession.
3. To gain knowledge on DPP (Development Project Proposals) and develop skills on public procurement of goods, works & service as per PPA and PPR.

COURSE CONTENT

An introduction to the code of ethics for engineer, relative importance of ethical issues in engineering and other professions, important vocabularies in ethics, scope, dilemma, impacts and related ethical issues in engineering profession, ethics in the workplace, fairness (personal and social), code of ethics of IEB (The Institution of Engineers, Bangladesh) and reputed engineering societies and case studies.
Project: characteristics, life cycle, types of contracts and estimates.
Project Proposals: preparation of various project and technical proposals according to planning commission's guidelines. PPA & PPR: salient features, principles of public procurement, methods and processing of procurement for goods and related services, works, physical services and their use, procurement of intellectual and professional services, e-government procurement, various schedules including standard tender documents, claims, disputes and arbitration procedure.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Able to ascertain the essential elements required at different phases of a project.	√	√										
2	CO2: Able to learn and understand code of ethics for engineers and will be ability to take an ethical decision after critical analysis of the situation.			√									
3	CO3: Able to understand DPP and make procurement of goods, works and services according to PPA & PPR.				√								

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to ascertain the essential elements required at different phases of a project.	1,2	C1, C2	1	1	1	Assignment, Mid-term, Final Exam
CO2	Able to learn and understand code of ethics for engineers and will be	3	C3, C4	1,2	1	1	Class Test, Final Exam

	ability to take an ethical decision after critical analysis of the situation.						
CO3	Able to understand DPP and make procurement of goods, works and services according to PPA & PPR.	4	C5	1,6	1	1	Assignment, Mid-term, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R – Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (2 hours/week × 14 weeks)	28
Guided Learning Tutorial/ Assignments (3 hours/week × 5 weeks)	10
Independent Learning • Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	24 13
Assessment Continuous Assessment Final Examination	2 3
Total	80

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Learning (PBL)

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction to the code of ethics for engineers	CT/ Assignment-1
	02	Introduction to the code of ethics for engineers	
2	03	Introduction to the code of ethics for engineers	
	04	Introduction to the code of ethics for engineers	
3	05	Important vocabularies in ethics, Ethics in workplace	
	06	Important vocabularies in ethics, Ethics in workplace	
4	07	Important vocabularies in ethics, Ethics in workplace	CT/ Assignment-2
	08	Important vocabularies in ethics, Ethics in workplace	
5	09	Code of ethics of IEB & reputed Engineering societies and Case studies	
	10	Code of ethics of IEB & reputed	

		Engineering societies and Case studies	
6	11	Code of ethics of IEB & reputed Engineering societies and Case studies	Mid Term/ Assignment-3
	12	Code of ethics of IEB & reputed Engineering societies and Case studies	
7	13	Code of ethics of IEB & reputed Engineering societies and Case studies	
	14	Code of ethics of IEB & reputed Engineering societies and Case studies	
8	15	Project: characteristics	
	16	Project life cycle, types of contracts and estimates	
9	17	Project life cycle, types of contracts and estimates	
	18	PPR 2016: Salient features,	
10	19	Principles of Public Procurement	
	20	Methods and Processing of Procurement for Goods and Related Services.	
11	21	Methods and Processing of Procurement for Goods and Related Services	
	22	Procurement of Intellectual and Professional Services	
12	23	E-Government Procurement	
	24	Various schedules including Standard Tender Documents, claims, disputes and arbitration procedure	
13	25	Various schedules including Standard Tender Documents, claims, disputes and arbitration procedure	
	26	Various schedules including Standard Tender Documents, claims, disputes and arbitration procedure	
14	27	Project Proposals: Preparation of various project and technical proposals according to Planning Commission’s guidelines.	
	28	Project Proposals: Preparation of various project and technical proposals according to Planning Commission’s guidelines.	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom’s Taxonomy**
Continuous Assessment (Class assignments/ CT/Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3, C4
Final Exam	60%	CO1, CO2, CO3	C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. A Manual of Ethics by Dr Jadunath Sinha
2. Ethics by William K Frankena
3. Engineering ethics: concepts and cases, second edition by Charle E. Haris Jr., Michael S. Pritchard, and Michael Rabins.
4. Philos Harris, Charles E. The Good Engineer: Giving Virtue its Due in Engineering Ethics. Sci Eng. Ethics (2008) 14:153–164
5. IEB code of Ethics, IEB, Bangladesh
6. NSPE code of Ethics
7. Project Management - Planning and Control by Albert Lester.
8. The Process of Management by William H. Newman.
9. Project Management by S Chowdhury
10. Business correspondence and Report Writing- A practical approach to business and technical communication by R C Sharma and Krisna Mohan
11. PPR 2008
12. DPP preparation guide book published by planning commission

COURSE INFORMATION	
Course Code: EWCE 461	Credit Hour: 3.0
Course Title: River Engineering and Flood Management	Contact Hour: 3.0

PRE-REQUISITE

EWCE- 363(Engineering Hydrology), EWCE-361(Open Channel Hydraulics)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will be presented with the basics of river engineering and morphological processes including sediment transport. Aggradation and degradation, basics of scouring process dredging and navigation processes. The students will be able to estimate scour depth and e familiar with the design considerations of river training and bank protection works. The students will also be able to understand the fundamental principles of floods, evaluate a range of flood management methods, encompassing both structural and non-structural measures and develop practical skills in flood risk assessment and mitigation.

OBJECTIVE

1. Demonstrate the understanding of the basics of river engineering and the morphological processes related to rivers.
2. Distinguish different types of sediment and understanding of the sediment movement, aggradation, and degradation.
3. Categorize the basics of scouring process and estimate the scour depth.
4. Familiar with river training and bank protective works and explain basic dredging processes and the navigation process.
5. Apply knowledge of flood processes and management strategies to analyze and assess flood risk.
6. Design comprehensive flood management plans integrating interdisciplinary perspectives

COURSE CONTENT

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

Flood and its causes, flood processes in rural and urban areas, methods of flood management: structural and non-structural measures such as reservoirs, levees and flood walls, channel improvement, interior drainage, floodways, land management, flood proofing, flood zoning, flood hazard mapping, flood forecasting and warning flood risk and damage.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to explain the relationships of river planforms with the river Morphological parameters	√											
2	CO2: Be proficient in calculating and estimating sediment distribution and sediment load of a river		√	√									

3	CO3: Be able to apply different engineering perceptions to estimating the scour depth.		√											
4	CO4: Be familiar with different bank protection and river training work and understand the dredging and navigation processes	√	√											
5	CO5: Apply knowledge of flood processes and management strategies to analyze and assess flood risk.		√											
6	CO6: Apply knowledge of flood processes and management strategies to analyze and assess flood risk.			√										

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to explain the relationships of river planforms with the river Morphological parameters	1	C2	1		1	Class Test, Final Exam,
CO2	Be proficient in calculating and estimating sediment distribution and sediment load of a river	2,3	C2			3	Class Test, Mid-term, Final Exam
CO3	Be able to apply different engineering perceptions to estimating the scour depth.	3	C3, C4	1		3,5	Class Test, Final Exam,
CO4	Be familiar with different bank protection and river training work and understand the dredging and navigation processes	1,2	C3, C4	1		3	Class Test, Final Exam,
CO5	Apply knowledge of flood processes and management	2	C3, C4	1		3	Class Test, Mid-term,

	strategies to analyze and assess flood risk.						Final Exam
CO6	Apply knowledge of flood processes and management strategies to analyze and assess flood risk.	3	C4	1,6		3,5	Class Test, Final Exam,

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R – Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self- Directed Learning	
• Non-face-to-face learning	25
• Revision of the previous lecture at home	21
• Preparation for final examination	21
Formal Assessment	
a) Continuous Assessment	8
b) Final Examination	3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Introduction to river engineering and its importance–Global and Bangladesh perspective	
	02	Explanations on river classifications based on planforms, sediment load, substrate and flood types	
	03	River planforms and their relationships with Morphological parameters	
2	04	Hydraulic geometry characteristic of a river and their interrelationships	CT1
	05	Hydraulic geometry characteristic of a river and their interrelationships	
	06	Sediment characteristics, sediment movement, Initiation of motion	
3	07	Sediment characteristics, sediment	

		movement, Initiation of motion	
	08	Sediment distribution–suspended load and bed load	
	09	Sediment load computation – suspended load and bed load with examples, Case studies from local rivers	
4	10	Regimes of flow, bed forms, grain roughness and form roughness	
	11	Regimes of flow, bed forms, grain roughness and form roughness	
	12	Aggradation and degradation–Lane 's equation and assessment of river equilibrium	
5	13	Aggradation and degradation–Lane 's equation and Assessment of river equilibrium	
	14	River scour, processes, factors affecting scour and relationships with hydraulic and morphological parameters	
	15	River scour, processes, factors affecting scour and relationships with hydraulic and morphological parameters	
6	16	Assessment of scour depth, live bed and clear water scour, complex pier, abutment scour	Mid Term Exam
	17	Introduction to river training and bank protection works–groynes, guide bank, revetments and ripraps	
	18	Design considerations of river training and bank protection works – groynes, guide bank, revetments and ripraps, case studies from local rivers	
7	19	Design considerations of river training and bank Protection works–groynes, guide bank, revetments and ripraps, case studies from local rivers	
	20	Navigation – importance, classification, Morphological issues, navigation lock, maintenance, and management issues	
	21	Dredging–importance, capital dredging, design, Maintenance and management issues, case studies from local rivers	
8	22	Introduction to flood and its causes	CT2
	23	Flood processes in rural areas	
	24	Flood processes in urban areas	
9	25	Introduction to methods of flood management	
	26	Structural measure: reservoirs	
	27	Structural measure: reservoirs	
10	28	Structural measure: levees	
	29	Structural measure: floodwalls	
	30	Structural measure: channel improvement	
11	31	Structural measure: interior drainage	
	32	Structural measure: floodways	

	33	Non-structural measure: land management	
12	34	Non-structural measure: flood proofing	CT3
	35	Non-structural measure: flood zoning	
	36	Non-structural measure: flood hazard mapping	
13	37	Nonstructural measure: flood forecasting and warning	
	38	Flood risk	
	39	Flood risk	
14	40	Flood damage	
	41	Flood hazard	
	42	Review class	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4, CO5	C2, C3, C4
Final Exam	60%	CO1, CO2, CO3, CO4, CO5	C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Principles of River Engineering – Chang
2. Principles of River Engineering- Garg
3. Mechanics of Sediment Transport and Alluvial River Problems – Garde and Ranga Raju
4. Sediment Transport Technology (Water & Sediment Dynamics) – Daryl B. Simons & Fuat Sentirk

COURSE INFORMATION	
Course Code: EWCE 462	Credit Hour: 1.5
Course Title: Computer Applications in Water and Environmental Engineering	Contact Hour: 3.0

PRE-REQUISITE
EWCE-261 (Fluid Mechanics), EWCE-361 (Open Channel Hydraulics), EWCE-331 (Water Supply Engineering)

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE
The course will provide students with the knowledge to effectively use computer program to analyze difficult hydraulic conditions in natural and constructed channels, utilizing one-dimensional and two-dimensional modeling techniques. This course will also cover the fundamentals of building and calibrating water distribution system models, which can be used for master planning, operational analysis of existing systems and design.

OBJECTIVE
1. To update and improve student's proficiency in flood analysis. 2. To learn how to evaluate and use different modeling program options. 3. To learn how to use program solutions for mixed flow, multiple culverts, bridge modeling, lateral structures and water distribution systems. 4. To calculate flows and head losses using field data, factors, controls and other parameters to design distribution systems.

COURSE CONTENT
Basic principles of modeling 1D and 1D/2D river flow, unsteady river flow modeling (1D), model interpretation, calibration and validation, modeling floods/hydraulic structures, modelling movement and fate of drinking water constituents within drinking water distribution systems/ Basic hydraulic modeling of sewerage networks.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to explain the basic principles of modeling 1D and 1D/2D river flow	√											
2	CO2: Be able to solve numerical approximation equations of open channel flow		√										
3	CO3: Be able to design a river model			√		√							
4	CO4: Be proficient to design a water distribution model for different practical applications			√		√							

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods

CO1	Be able to explain the basic principles of modeling 1D and 1D/2D river flow	1	C2	-	-	2	Assignment/Test, Quiz
CO2	Be able to solve numerical approximation equations of open channel flow	2	C3	-	-	2	Assignment/Test, Quiz
CO3	Be able to design a river model	3, 5	C5	-	-	2,5	Assignment/Test, Quiz
CO4	Be proficient to design a water distribution model for different practical applications	3, 5	C5	1	-	2,5	Assignment, Quiz, Presentation

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA=
Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge
Profile/ KP= Knowledge Profile
*Level of Bloom's Taxonomy:

C1- Remember	C2- Understand	C3- Apply	C4- Analyze	C5- Evaluate	C6- Create

(T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 24 8 --
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 12 3 10
Formal Assessment • Continuous Assessment • Final Examination	 1 2
Total	60

TEACHING METHODOLOGY

Lectures, Software Demonstrations

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	1	Introduction to hydrodynamic modeling	Assignement/Test
2	2	Definition and examples, review of mass balance, momentum and energy equations	
3	3	Different hydrodynamic models and their applications and limitations	
4	4	Different hydrodynamic models and their applications and limitations (Cont.)	Assignement/Test

5	5	Different hydrodynamic models and their applications and limitations (Cont.)	
6	6	Mid Quiz	
7	7	Understanding the movement of drinking water constituents within distribution systems	Assignement/Test
8	8	Understanding the movement of drinking water constituents within distribution systems (Cont.)	
9	9	Introduction to modeling of water distribution systems	Assignement/Test
10	10	Optimizing operations of tanks and pumps	
11	11	Optimizing operations of tanks and Pumps (Cont.)	
12	12	Optimizing operations of tanks and Pumps (Cont.)	
13	13	Final Quiz	
14	14	Presentation	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class Assessment/ Project/Class performance)	35%	CO1, CO2, CO3, CO4	C2, C3, C5
Mid Quiz+ Final Quiz	50%	CO1, CO2, CO3, CO4	C2, C3, C5
Presentation	15%	CO4	C5
Total Marks	100%		

REFERENCE BOOKS

1. Hydraulic Modelling: An Introduction: Principles, Methods and Applications, Pavel
2. Novak, Vincent Guinot, Alan Jeffrey, Diminic E. Reeve.
3. Computer Modelling of Water Distribution Systems, James P. Cooper. User Manual and application guide of the related software.

COURSE INFORMATION	
Course Code: EWCE 463	Credit Hour: 3.0
Course Title: Irrigation and Drainage Engineering	Contact Hour: 3.0

PRE-REQUISITE

EWCE363(Hydrology), EWCE-361(Open Channel Hydraulics)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will be presented with the irrigation principles and practices, crop and irrigation water requirement, irrigation scheduling, irrigation water quality, irrigation pumps, drainage criteria and design, irrigation and drainage structures and irrigation water management. Knowledge gained from this course will be useful in professional life.

OBJECTIVE

1. To gain knowledge on irrigation and drainage principles and practices.
2. To become skilled in determining irrigation water requirements and irrigation scheduling.
3. To be able to design surface and subsurface drainage systems.
4. To be familiar with irrigation and drainage structures, irrigation pumps and their design criteria.

COURSE CONTENT

Importance of irrigation, soil water physics, crop/irrigation water requirements and scheduling of irrigation methods and design, sources and quality of irrigation water, soil and water salinity, irrigation and drainage structures, irrigation pumps, drainage criteria, steady state drainage system, surface/subsurface drainages systems design, irrigation water management, Irrigation projects in Bangladesh.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to **estimate** the irrigation water requirement of any crop considering the Crop’s characteristics, soil and climatic data and perform irrigation scheduling	√	√										
2	CO2: Be expert in **identifying/preliminarily selecting/ designing** irrigation and drainage structures, flow measurement devices and irrigation pumps for efficient operation and management of irrigation and drainage projects.		√	√									
3	CO3: Be able to **apply** engineering perceptions to improve the management of irrigation and irrigation efficiency	√	√										
4	CO4: Be proficient in **assessing** the drainage requirement of any crop and to design the necessary surface/subsurface drainage system.		√	√									

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **estimate** the irrigation water requirement of any crop considering the Crop’s characteristics, soil and climatic data and perform irrigation scheduling	1,2	C2, C3			1	Class Test, Mid Term, Final Exam,
CO2	Be expert in **identifying /preliminarily selecting/ designing** irrigation and drainage structures, flow measurement devices and irrigation pumps for efficient operation and	2,3	C2, C4			1, 2,5	Class Test, Mid-term, Final Exam

	management of irrigation and drainage projects						
CO3	Be able to **apply** engineering perceptions to improve the management of irrigation and irrigation efficiency	1,2	C3	1		3	Class Test, Final Exam
CO4	Be proficient in **assessing** the drainage requirement of any crop and to design the necessary surface/subsurface drainage system	2,3	C2, C4			1,2, 5	Class Test, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 42 - -
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 9 18 46
Formal Assessment c) Continuous Assessment d) Final Examination	 2 3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Introduction to Irrigation and its importance–global and Bangladesh perspective	
	02	History and development of irrigation–surface water and groundwater, crops, cropping pattern and intensity	
	03	Soil physics in relation to irrigation and drainage, Soil and water relationships	
2	04	Soil moisture measurement–direct and indirect methods	CT1
	05	Soil water suction Tensiometers, Soil characteristic curves and moisture holding capacity	
	06	Soil-plant-water relationships, Evaporation, Transpiration and Evapotranspiration	
3	07	Crop water requirement (CWR), Factors affecting	

		CWR	
	08	CWR–measurement and estimation, CROPWAT	
	09	Irrigation water requirement (IWR) and effective rainfall	
4	10	Example problems on CWR and IWR	
	11	Irrigation water requirement (IWR) of rice, Seepage and percolation loss and land preparation requirement	
	12	Irrigation Efficiency, concepts and classification	
5	13	Conveyance loss measurement–Ponding Method with examples	
	14	Irrigation scheduling–concepts, methods and analysis	
	15	Irrigation scheduling–analysis with examples	
6	16	Irrigation methods, classification, advantage and disadvantages	
	17	Design of surface and subsurface irrigation with examples	Mid Term Exam
	18	Design of surface and subsurface irrigation with examples	
7	19	Design of surface and subsurface irrigation with examples	
	20	Irrigation water quality and quality standards	
	21	Soil and water salinity, remedial measures and Leaching requirement with examples	
8	22	Irrigation and drainage structures, types and purposes	
	23	Irrigation and drainage structures – design Considerations and examples	CT2
	24	Flow measurement structures with examples	
9	25	Design of irrigation and drainage canals – erodible and lined canal design considerations	
	26	Design of irrigation and drainage canals–best hydraulic section with examples	
	27	Design of irrigation and drainage canals–Regime theory with examples	
10	28	Irrigation pumps, classification, components and operation	
	29	Pump characteristic curves, BOP and efficiency with examples	
	30	Pump in series and parallel, pump selection	
11	31	Irrigation management, concepts and importance	
	32	Irrigation management – improving irrigation efficiency, water saving techniques in rice irrigation	
	33	Irrigation management –people ‘s participation	
12	34	Drainage of agricultural land– concepts, definitions and importance	CT3
	35	Drainage of agricultural land– surface and subsurface systems	
	36	Surface drainage systems –deign considerations	
13	37	Subsurface drainage systems–deign considerations of Steady state design	
	38	Surface drainage systems–deign examples	
	39	Subsurface drainage systems –deign examples	
14	40	Subsurface drainage systems –deign examples	

	41	Irrigation and drainage systems of Bangladesh– present status and future potentials of major and minor irrigation	
	42	Irrigation and drainage systems of Bangladesh– Present status and future potentials of major and minor irrigation	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C3, C4
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Irrigation Engineering and Hydraulic Structures– Garg
2. Irrigation Principles and Practices–Vaughn, E.Hansen, OrsonW.Israelsen
3. Introductory Irrigation Engineering–B.C.Punmia
4. Drainage Principles and Applications –ILRI

COURSE INFORMATION

Course Code: EWCE 464	Credit Hour: 1.5
Course Title: Advanced Applications of GIS and RS	Contact Hour: 3.0

PRE-REQUISITE

EWCE-103 (Surveying), EWCE-104 (Practical Surveying), EWCE-206 (GIS in Environmental and Water Resources Engineering)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This course will impart cutting-edge knowledge and practical-based skills among the students through rigorous theory, practical work and hands-on training focused on key and applied aspects of GIS and remote sensing.

OBJECTIVE

1. To introduce students with newer approaches on data sciences, analytics, big geospatial data.
2. To include advanced application of GIS, its management and implementation.
3. To understand the basic remote sensing technology and satellite derived data (image, climatic variables etc.).
4. To impart knowledge and hands on training on latest GIS and RS software.

COURSE CONTENT

Introduction to raster data, introduction to surface data: TIN, DEM, spatial analyst, model builder, 3D Analyst, geo statistical analyst.
Introduction to Remote Sensing data/satellite images, browsing Satellite data from USGS website, study of satellite image annotation (information) - LANDSAT and other open sources, image enhancement, image classification (supervised, unsupervised), calculation of soil, water and vegetation indices, remote sensing in hydro meteorological disasters (monitoring of flood, drought and storms), remote sensing application in geohazard (earthquake/landslide), introduction to image processing software.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)

		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Ability to **recognize** the advance tools of Geographic Information Systems (GIS)	√											
2	CO2: Ability to **produce** contour maps, DEM from spot height geographic data using visualization concepts such as color theory and symbolization and GIS tools					√							
3	CO3: Ability to **analyze** geospatial problems and/or research questions with the help of basic GIS analysis tools		√			√							
4	CO4: Be able to **apply** remote sensing for primary purposes like digitizing, geoprocessing, map preparation, change detection, mobile application with Google map survey, satellite image processing		√			√							

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to **recognize** the advance tools of Geographic Information Systems (GIS)	1	C1	-	-	1	M, F
CO2	Ability to **produce** contour maps, DEM from spot height geographic data using visualization concepts such as color theory and symbolization and GIS tools	5	C3	-	-	1	T, M
CO3	Ability to **analyze** geospatial problems and/or research questions with the help of basic GIS analysis	2, 5	C2, C4	-	-	4,6	T, M, F

	tools						
CO4	Be able to **apply** remote sensing for primary purposes like digitizing, geoprocessing, map preparation, change detection, mobile application with Google map survey, satellite image processing	2, 5	C3	-	-	4,6	PR, F
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1- Remember C2- Understand C3- Apply C4- Analyze C5- Evaluate C6- Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 24 8 --
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 12 3 10
Formal Assessment • Continuous Assessment • Final Examination	 1 2
Total	60

TEACHING METHODOLOGY

Lectures, Software Demonstrations

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	1	Introduction to Raster data, Raster analysis	Test, Mid Quiz
2	2	DEM, Generating Contour and DEM from spot heights	
3	3	Introduction to Advanced GIS Tools, Watershed delineation using Hydrology tool	
4	4	Spatial Analyst	
5	5	Geo statistical Analyst	
6	6	Mid Quiz	
7	7	3D Analyst	Project, Test, Final Quiz
8	8	Model Builder	
9	9	Introduction to RS techniques, satellite images	
10	10	Remote Sensing Indices	

11	11	Image Classification (Unsupervised)	
12	12	Image Classification (Supervised)	
13	13	Morphological changes using satellite images	
14	14	Final Quiz, Project submission	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class Assessment/Project/Class performance)	40%	CO1, CO2, CO3, CO4	C1, C2, C3, C4
Mid Quiz+ Final Quiz	60%	CO1, CO2, CO3, CO4	C1, C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Remote Sensing and GIS, Basudeb Bhatta.
2. Manuals developed by ESRI.
3. Advanced Remote Sensing and GIS Training manual developed by CEGIS, USFS and BFD.

COURSE INFORMATION	
Course Code: EWCE 465	Credit Hour: 3.0
Course Title: Design of Hydraulic Structures	Contact Hour: 3.0

PRE-REQUISITE

Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will learn to design weir, barrage, dam as well as coastal structure such as sea wall, groynes so on which will be helpful in their professional life in designing different type of hydraulic structures.

OBJECTIVE

1. To gain knowledge on the basics of designing hydraulic structures.
2. To know the design details of inland as well as coastal structures.

COURSE CONTENT

Hydraulic structures – characteristics and types; Principles of design hydraulic structures including failure phenomenon, static and dynamic loading; Design of dams, barrages, weirs, spillways, energy dissipators, reservoir, revetment, seawall, breakwaters.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: To understand the basic principles and analysis of both static and dynamic water loads, failure characteristics and details of different types of hydraulics structures	√											
2	CO2: To know the	√											

	basic principles and concepts of analysis and design of different types of hydraulic structures.												
3	CO3: To apply basic design calculations of different hydraulic structures			√									

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	To understand the basic principles and analysis of both static and dynamic water loads, failure characteristics and details of different types of hydraulics structures	1	C2	1,3		1	Class Test, Final Exam
CO2	To know the basic principles and concepts of analysis and design of different types of hydraulic structures	1	C2			3	Class Test, Mid-term, Final Exam
CO3	To apply basic design calculations of different hydraulic structures	3	C3	1,3		4,5	Assignment, Class Test, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA=Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember, C2 – Understand, C3- Apply, C4 – Analyze, C5 - Evaluate, C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning	
a) Lecture	42
b) Practical/ Tutorial/ Studio	--
c) Student – Centered Learning	--

Self- Directed Learning a) Non-face-to-face learning b) Revision of the previous lecture at home c) Preparation for the final examination	9 18 46
Formal Assessment c) Continuous Assessment d) Final Examination	2 3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction	
	02	Principles of design of hydraulic structures	
	03	Types of hydraulic structures	
2	04	Theories of seepage	Assignment/ CT1
	05	Bligh's theory	
	06	Khosla's theory	
3	07	Percentage of pressure and exit gradient	
	08	Diversion head works	
	09	Protection works for surface and sub-surface flow	
4	10	Theory of Weir	
	11	Design of weir	
	12	Design of weir	
5	13	Theory of Barrage	
	14	Design of Barrage	
	15	Theory of dam	Assignment/ CT2
6	16	Design of dam	
	17	Design of dam	
	18	Theory and design of spillway	
7	19	Theory and design of energy dissipaters	Mid Term Exam/ Project
	20	Introduction to reservoirs	
	21	Capacity of Reservoir storage	
8	22	Basics of cross drainage works	
	23	Design of cross drainage works	
	24	Reviewing of abovementioned structures	
9	25	Introduction to coastal structures	
	26	Structure types	
	27	Structure types	
10	28	Design criteria of coastal structures	
	29	Design criteria of coastal structures	
	30	Material used in coastal structures	
11	31	Material used in coastal structures	
	32	Introduction to marine Environment	
	33	Deterioration due to marine environment	
12	34	Deterioration due to marine environment	
	35	Repair of coastal structures	
	36	Rehabilitation of coastal structures	
13	37	Planning of coastal structures	
	38	Theory of shore protection works	
	39	Theory of shore protection works	
14	40	Design considerations of shore protection works	CT 3
	41	Design considerations of shore protection works	
	42	Review of coastal structures	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3
Final Exam	60%	CO1, CO2, CO3	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. Hydraulic Structures by Garg (Text)
2. Irrigation and Water Power Engineering by Punmia (Text)
3. Irrigation and Water Resources Engineering by Asawa
4. Theory and Design of Irrigation Structure by Varshney
5. Dam and Appurtenant Hydraulic Structure by Ljubomir Tanchew

COURSE INFORMATION	
Course Code: EWCE 466	Credit Hour: 1.5
Course Title: Hydraulic Structure Design Sessional	Contact Hour: 3.0

PRE-REQUISITE

EWCE - 261 (Fluid Mechanics), EWCE - 363 (Engineering Hydrology), EWCE - 213(Structure Analysis I), CE - 385 (Design of Concrete Structures I), EWCE - 343 (Geotechnical Engineering-II: Foundation Engineering), EWCE - 361 (Open Channel Hydraulics), EWCE - 471 (Coastal Engineering)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will learn to design a regulator as well as guide bank which will be helpful in their professional life in designing hydraulic structures.

OBJECTIVE

1. To gain knowledge on the basics of hydrological, hydraulic and structural design requirements of a hydraulic structure.
2. To understand the basic design principle of hydraulic structure and guide bank.
3. To become skilled at the design and construction of different hydraulic structures.

COURSE CONTENT

Introduction to hydraulic structure design and design requirements, basic techniques of hydrologic design, detail hydraulic design of a small hydraulic structure (3 vent regulator) and design of the structural elements of a regulator and stability analysis, design of guide bank.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Be able to **understand** the basic requirements of hydrological, hydraulic and structural design of a hydraulic structure.	√											
2	Be able to **estimate** hydrological parameters for a catchment area and hydraulic parameters of the structure.	√											

3	Be able to **compute** design loads,pressures and analyze stability of a hydraulic structure.			√									

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **understand** the basic requirements of hydrological, hydraulic and structural design of a hydraulic structure.	1	C2	1	–	3	Lab report, Mid Quiz
CO2	Be able to **estimate** hydrological parameters for a catchment area and hydraulic parameters of the structure.	1	C2, C3	1	–	3, 5	Lab report, Mid Quiz
CO3	Be able to **compute** design loads, pressures and analyze stability of a hydraulic structure.	3	C3	1, 7	–	3, 5, 6	Lab report, Final Quiz
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom’s Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture (3 hours/week × 12 weeks)	36

Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home Preparation for Quiz	2 3 5
Formal Assessment • Lab reports • Quiz	11 3
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	1	Introduction and Design of a Regulator (Hydrologic Design Part 1)	Lab Reports
2	2	Design of a Regulator (Hydrologic Design Part 2)	
3	3	Design of a Regulator (Hydraulic Design 1)	
4	4	Design of a Regulator (Design of Stilling Basin (contd.) and Determination of Floor Thickness)	
5	5	Design of a Regulator (Design of floor thickness (pre monsoon) and loose protection)	
6	6	Design of a Regulator (Design of floor thickness (post monsoon) and loose protection)	
7		Mid Quiz	Quiz
8	7	Structural Design of a 3-vent Regulator: 1. Box Conduit (Post - Monsoon Condition)	Lab Reports
9	8	Structural Design of a 3-vent Regulator: 2. Wing Wall	
10	9	Structural Design of a 3-vent Regulator: 3. Design of Apron	
11	10	Structural Design of a 3-vent Regulator: 4. Retaining Wall	
12	11	Design of Guide Bank	
13	12	Design of Guide Bank (continued)	
14	13	Final Quiz	Quiz

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Lab reports/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3
Quiz	60%	CO1, CO2, CO3	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. Irrigation Engineering & Hydraulic Structures - Santosh Kumar Garg
2. Principles of River Engineering – Garg

COURSE INFORMATION	
Course Code: EWCE 467	Credit Hour: 3.0
Course Title: Integrated Water Resources Management	Contact Hour: 3.0

PRE-REQUISITE

EWCE363(Hydrology)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This course introduces students to Integrated Water Resources Management (IWRM). This course gives the students of water resources management a wider understanding of IWRM and the procedures and tools available for its implementation.

OBJECTIVE

1. To be able to explain the basic principles of and practices of IWRM
2. To enhance student ‘s capacity to plan water resources development.
3. To provide an understanding of principles of catchment management including policies, strategies and institutional arrangements for IWRM
4. To be familiar with measures to protect water resources including laws and regulations governing water resources.
5. To foster an understanding of the complexities surrounding water governance, water rights, and water conflicts, including economic perspectives, basin-wise management approaches, and strategies for water sharing

COURSE CONTENT

IWRM Concept and Principles: Impacts of fragmented approach and importance of integration, Implementing IWRM, Planning fundamentals and processes: Multi-criteria analysis: Functions of water resources systems: Introduction to Demand Management. Water management and sustainable development: concepts and challenges, Case studies.

Basin-wide management and water sharing: Water resources management and development issues in co-riparian countries, Water management interventions and regional implications, Development and codification of international law, Benefits of Integrated basin management.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to **explain** the basic Principles and practice of IWRM	√											
2	CO2: Be able to **apply** engineering perceptions to explain policies, strategies and institutional arrangements for IWRM		√										
3	CO3: Be able to apply analytical skills to evaluate and assess various aspects of water resources management, including in-stream flow assessment, water allocation strategies, and analysis of flood and low-		√	√									

	flow scenarios, to propose sustainable solutions for water resource challenges.												
4	CO4: To develop critical thinking and problem-solving abilities in addressing complex water management issues, including water conflicts, water rights, and basin-wise management approaches, while considering socio-economic, environmental, and political factors		√		√								
5	CO5: To impart the concepts of sustainable development in water management, sustainability indices and SDG goals							√					

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **explain** the basic Principles and practice of IWRM	1	C2	1		1, 3	Class Test, Final Exam,
CO2	Be able to **apply** engineering perceptions to explain policies, strategies and institutional arrangements for IWRM	2	C3	1, 3		4, 7	Class Test, Final Exam
CO3	Be able to apply analytical skills to evaluate and assess various aspects of water resources management, including in-stream flow assessment, water allocation strategies, and analysis of flood and low-flow scenarios, to propose sustainable solutions for water resource challenges.	2,3	C4	1, 3		1, 5	Class Test, Final Exam
CO4	To develop critical thinking and problem-solving abilities in addressing complex water management issues, including water conflicts, water rights, and basin-wise management approaches, while considering socio-economic, environmental, and political	2,4					

	factors						
CO5	To impart the concepts of sustainable development in water management, sustainability indices and SDG goals	7	C1, C2	1		1,4	Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember, C2 – Understand, C3- Apply, C4 – Analyze, C5 - Evaluate, C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self- Directed Learning	
• Non-face-to-face learning	9
• Revision of the previous lecture at home	18
• Preparation for final examination	46
Formal Assessment	
e) Continuous Assessment	2
f) Final Examination	3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Introduction to IWRM	
	02	IWRM Concept	
	03	IWRM Principles	
2	04	Impacts of fragmented approach	CT1
	05	Importance of integration	
	06	Implementing IWRM	
3	07	Implementing IWRM	
	08	Planning fundamentals and processes	
	09	Multi-criteria analysis	Mid Term Exam
4	10	Multi-criteria analysis	
	11	Functions of water resource systems	
	12	Introduction to Demand Management	
5	13	Demand Management	
	14	Water management and sustainable development	
	15	Sustainable development goals	
6	16	Sustainable development goal: 6 and its target	
	17	Water management and sustainable development: Concept sand challenges	

	18	Water management and sustainable development: Concepts and challenges	
7	19	Case studies	
	20	Case studies	
	21	Review class	
8	22	Introduction and overview of WRS	
	23	Use, Demand, Availability of water	CT2
	24	Use, Demand, Availability of water	
9	25	Introduction to In-stream flow assessment	
	26	Methods of in-stream flow assessment	
	27	Work out examples of in-stream flow assessment	
10	28	Water allocation	
	29	Flood flow and low flow analysis	
	30	Work out examples of flood flow and low flow analysis	
11	31	Water rights in terms of IWRM	
	32	Water rights: Economic view	
	33	Waster use efficiency and Productivity	
12	34	Groundwater demand and use	CT3
	35	Groundwater resources management	
	36	Basin wise River Management	
13	37	Basin wise River Management	
	38	Water Governance	
	39	Stakeholder participation in IWRM	
14	40	Water Use and Conflicts	
	41	Conflict Resolution Tools	
	42	Review class	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C1, C2, C3, C4
Final Exam	60%	CO1, CO2, CO3, CO4	C1, C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. McDonald, A.T and Kay,D(1998). Water Resources:I ssues and Strategies. Longman Scientific and Technical.
2. Chapman, D. (1992). Water management and Environmental Engineering. Chapman and Hall.
3. Feachem, R, McGarry, M.and Mara, D (1977). Water, Wastes and Health in Hot Climates. Wiley.
4. The World Bank, Washington, D.C (2000) Water Resources Management, A World Bank Policy Paper, Global Water Partnership.
5. UN-ESCAP (1996). Integrated Water Resources Management, TAC Background Papers No.4, Global Water Partnership Technical Advisory Committee, Sweden.
6. Morgan, P. (1990). Rural Water Supplyand Sanitation. McMillan.

COURSE INFORMATION	
Course Code: EWCE 468	Credit Hour: 1.5
Course Title: Water Modelling Sessional	Contact Hour: 3.0
PRE-REQUISITE	
EWCE 206 (GIS in Environmental and Water Resources Engineering), EWCE 464 (Advanced GIS and RS Sessional)	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
This course will develop a quantitative approach to understand, estimate, and predict the different components of the hydrologic cycle.	
OBJECTIVE	
1. Modeling of the following processes will be discussed in this course: interception, snow melt, evapotranspiration, infiltration, groundwater flow, overland runoff, stream flow, sediment erosion and deposition, and transport of contaminants in streams. 2. The course discusses in detail multiple model representations of hydrologic processes and limitations and uncertainty associated with each.	
COURSE CONTENT	
Hydrologic modeling overview, inputs & data preprocessing, model operation & application, model interpretation, model calibration and evaluation, 2D hydrodynamic modeling overview, grid generation and bathymetry interpolation, boundary conditions, 2D flow simulation, post processing.	
SKILL MAPPING (CO – PO MAPPING)	

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Able to understand how and where a given model can be used, and will be prepared to address water quantity (e.g. floods, droughts, climate change impacts etc.) using hydrologic modelling software.	√											
2	CO2: Able to perform bathymetry interpolation and generate curve number grid for various hydrologic model.		√	√									
3	CO3: Able to develop hydrologic and hydrodynamic model along with calibration and evaluation.			√									

COURSE OUTCOMES & GENERIC SKILLS

<table>
<tr><td>No</td><td>Course Outcome</td><td>Corresponding POs</td><td>Bloom’ s Taxonomy*</td><td>CP</td><td>CA</td><td>KP</td><td>Assessment Methods</td></tr>
<tr><td>CO1</td><td>Able to understand how and where a given model can be used, and will be prepared to address water quantity (e.g. floods, droughts, climate change impacts etc.) using hydrologic modelling software.</td><td>1</td><td>C2</td><td>-</td><td>–</td><td>1</td><td>Test, Quiz, Assignment</td></tr>
<tr><td>CO2</td><td>Able to perform bathymetry interpolation and generate curve number grid for various hydrologic model.</td><td>2,3</td><td>C4, C5</td><td>-</td><td>–</td><td>2</td><td>Test, Quiz, Assignment</td></tr>
<tr><td>CO3</td><td>Able to develop hydrologic and hydrodynamic model along with calibration and evaluation.</td><td>3</td><td>C5</td><td>1</td><td>–</td><td>5</td><td>Quiz, Presentation</td></tr>
<tr><td></td><td colspan="7">WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile
*Level of Bloom’s Taxonomy:
C1 – Remember   C2 – Understand   C3- Apply   C4 – Analyze   C5 - Evaluate   C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)</td></tr>
<tr><td colspan="8">TEACHING AND LEARNING STRATEGY</td></tr>
<tr><td colspan="4">Teaching and Learning Activities</td><td colspan="4">Engagement (Hours)</td></tr>
<tr><td colspan="4">Face-to-face Learning
• Lecture
• Practical/ Tutorial/ Studio
• Student – Centered Learning</td><td colspan="4">
22
11
--</td></tr>
<tr><td colspan="4">Guided Learning
Tutorial/ Assignments</td><td colspan="4">
6</td></tr>
<tr><td colspan="4">Self- Directed Learning
• Independent Learning Individual Learning + Preparation for Quiz</td><td colspan="4">8</td></tr>
<tr><td colspan="4">Formal Assessment
a) Continuous Assessment
b) Quiz
c) Presentation</td><td colspan="4">
3
5
5</td></tr>
<tr><td colspan="4">Total</td><td colspan="4">60</td></tr>
<tr><td colspan="8">TEACHING METHODOLOG</td></tr>
<tr><td colspan="8">Lecture and Discussion, Problem Based Method</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="8">COURSE SCHEDULE</td></tr>
</table>

Week	Lecture	Topics to be Covered	Assessment
1	01	Introduction	Assignment/Test
2	02	Creating SCS Curve Number Grid using HEC-GeoHMS	
3	03	HEC-HMS: Model Components (Control Specification)	Assignment/Test
4	04	Developing a HEC-HMS Model (Manual and Auto- calibration of Model)	
5	05	Developing a HEC-HMS Model (Manual and Auto Calibration, Validation)	
6	06	Developing a HEC-HMS Model (Routing a hydrograph	Assignment/Test
7	07	Developing a HEC-HMS Model (Investigating Base-flow)	
8	08	Sensitivity analysis	
9		Mid Quiz	
10	09	Introduction into grid generation for flexible grids	Assignment/Test
11	10	Introduction on bathymetry interpolation	
12	11	Set-up of hydrodynamic model and running this model	Assignment/Test
13	12	Introduction on post processing.	
14		Final Quiz and Presentation	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Assignment/Test/ Mid Term/ Active Class Participation/ Presentation)	50%	CO1, CO2, CO3	C2, C4, C5
Quiz	50%	CO1, CO2, CO3	C2, C4, C5
Total Marks	100%		

REFERENCE BOOKS

1. Mathematical Models of Large Watershed Hydrology, Vijay P. Singh, Donald K. Frevert.
2. Distributed Hydrologic Modeling Using GIS, Baxter E. Vieux.
3. Lab Manuals

COURSE FORMATION	
Course Code: EWCE 469	Credit Hour: 2.0
Course Title: Mathematical Modelling in Water Resources Engineering	Contact Hour: 2.0

PRE-REQUISITE
MATH 101 (Differential and Integral Calculus), EWCE 205 (Numerical Methods), CSE 278 (Computer Programming and Computation Sessional)
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/ RATIONALE
This course is an introduction to mathematical modeling to use elementary functions to investigate and analyze real-world data, applied problems and questions, supported by the use of appropriate technology, and on effective communication of quantitative Concepts and results.
OBJECTIVE
1. To model situations from a variety of settings in generalized mathematical forms. 2. To express and manipulate mathematical information, concepts, and thoughts in verbal, numeric, graphical and symbolic form while solving a variety of problems. 3. To solve multiple-step problems through different modes of reasoning. 4. To properly use appropriate technology in the evaluation and analysis.
COURSE CONTENT
Concepts of mathematical modeling, differential equations and solution techniques: method of characteristics, finite difference and finite element methods, consistency, stability and convergence of numerical schemes, schematization and boundary conditions, calibration and validation, practical application in modeling river flow, groundwater flow, coastal water and advection-dispersion processes.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: **Solve** applications using a variety of problem solving strategies including geometric and algebraic techniques, linear and non-linear equations, statistical methods etc.	√	√										
2	CO2: **Use** computational tools to develop mathematical models and evaluate their efficacy.					√							

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods

CO1	**Solve** applications using a variety of problem-solving strategies including geometric and algebraic techniques linear and non-linear equations, statistical methods etc.	1, 2	C3, C4	1, 2	–	2	Assg/T, M,F
CO2	**Use** computational tools to develop mathematical models and evaluate their efficacy.	5	C5, C6	1, 2, 3	–	6	Assg/T, M,F
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning ● Lecture ● Practical/ Tutorial/ Studio ● Student – Centered Learning	 28 16 --
Self- Directed Learning ● Non-face-to-face learning ● Revision of the previous lecture at home ● Preparation for final examination	 05 8 18
Formal Assessment ● Continuous Assessment ● Final Examination	 02 03
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	1	An Introduction to Mathematical Modeling	CT/ Assignment/ Final Exam
	2	Modeling Scales and Representation	
2	3	Classification of Models	
	4	Stages of modeling	
3	5	Building Models: System Analysis	
	6	Choosing mathematical equations: Equations from the	

		literature	
4	7	Solving equations: Dimensionless form	CT/ Assignment/ Final Exam
	8	Solving equations: Asymptotic behavior	
5	9	Solving equations: Numerical Methods	
	10	Solving equations: Numerical Methods	
6	11	Solving equations: Numerical Methods	Mid Term/ Assignment/ Final Exam
	12	Stability and convergence of numerical schemes,	
7	13	Schematization and boundary conditions.	
	14	Model calibration	
8	15	Sensitivity analysis	
	16	Modelling model output	
9	17	Testing the assumptions, Model Structure	
	18	Estimating model parameters	
10	19	Comparison of Models	
	20	Using models: Predictions, Decision Support	
11	21	Practical application in modeling river flow	
	22	Practical application in modeling groundwater flow	
12	23	Practical application of modeling coastal water	CT/ Assignment/ Final Exam
	24	Modeling advection-dispersion processes	
13	25	Mathematical modelling methods to analyze big data	
	26	Mathematical modelling methods to analyze big data	
14	27	Project Submission	
	28	Project Submission	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2	C3,C4,C5,C6
Final Exam	60%	CO1, CO2	C3,C4,C5,C6
Total Marks	100%		

REFERENCE BOOKS

1. An Introduction to Mathematical Modelling Glenn Marion
2. An Introduction to Mathematical Modeling, Edward A.Bender.
3. Mathematical Modeling and Simulation, Kai Velten.

COURSE INFORMATION

Course Code: EWCE 471	Credit Hour: 3.0
Course Title: Coastal Engineering	Contact Hour: 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE
In this course students will be able to learn the basics of coast and coastal features; deltas and estuaries; tide; wave; storm surge; tsunami; port, dock and harbour; wave forces on coastal structures; coastal sedimentation processes. After this course, they will become skilled at designing and constructing different types of shore protection works, enhancing their skills of designing coastal structures in professional life.
OBJECTIVE
1. To understand characteristics of tides, theory behind tidal analysis and prediction, tidal flow measurement 2. To understand and apply the principles of coastal processes, sediment transport, deltas and delta management plan, estuary and estuarine control 3. To be skilled at fundamental concepts in designing shore protection works.
COURSE CONTENT
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 harbour structures, coastal water level fluctuation - storm surge, tsunami and basin oscillation, coastal zone processes, deltas and its characteristics, estuary and estuary control, docks and harbours, design of shore protection works.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: **Understand** the coastal and estuarine processes, including the formation of coastal features, deltas, and estuaries and **analyze** the key factors influencing coastal zone dynamics.	√											
2	CO2: **Analyze** tides and currents, including the measurement of tidal flows and **understand** the forces of waves and tides and their impact on the design of coastal and harbor structures.	√											
3	CO3: **Apply** knowledge of wave characteristics and forces to design coastal and harbor structures and the ability to incorporate considerations such as tidal flow, wave impact, and coastal water level fluctuations in the design process.	√											
4	CO4: **Analyze** and assess coastal hazards, including storm surges, tsunamis, and basin oscillations.		√										
5	CO5: **Apply** engineering principles to address			√									

	erosion, sedimentation, and other challenges in coastal areas, ensuring sustainable and effective solutions and proficiency in the design and planning of shore protection works.												

No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
COURSE OUTCOMES & GENERIC SKILLS							
CO1	**Understand** the coastal and estuarine processes, including the formation of coastal features, deltas, and estuaries and **analyze** the key factors influencing coastal zone dynamics.	1	C2,C4	1	–	1	Pop Quiz, Final Exam
CO2	**Analyze** tides and currents, including the measurement of tidal flows and **understand** the forces of waves and tides and their impact on the design of coastal and harbor structures.	1	C2,C4	1	–	1	Class Test, Mid-Term, Final Exam
CO3	**Apply** knowledge of wave characteristics and forces to design coastal and harbor structures and the ability to incorporate considerations such as tidal flow, wave impact, and coastal water level fluctuations in the design process.	1	C3	1	–	1	Mid-Term, Final Exam
CO4	**Analyze** and assess coastal hazards, including storm surges, tsunamis, and basin oscillations.	2	C4	1	–	1	Class Test, Mid-Term, Final Exam
CO5	**Apply** engineering principles to address erosion, sedimentation, and other challenges in coastal areas, ensuring sustainable and effective solutions and proficiency in the design and planning of shore protection works.	3	C3	1	–	1, 5	Class Test, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile						

	*Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Self- Directed Learning ● Non-face-to-face learning ● Revision of the previous lecture at home ● Preparation for final examination	09 18 46
Formal Assessment ● Continuous Assessment ● Final Examination	02 03
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	1	Definitions and nomenclature of the coastal zones, Typical beach profiles	CT/ Assignment/ Final Exam
	2	Coastal diversity, human and coastal zones	
	3	Factors influencing coastal morphology and processes	
2	4	Tides and coastal processes: Terms and Definitions, Characteristics of tides, Tide chart	
	5	Theory behind tidal analysis and prediction, Methods of tidal analysis and prediction	
	6	Harmonic analysis of water level and current data, Non-Harmonic analysis of water level and current data-Problem	
3	7	Definition of wave parameters, waves and its characteristics-concept	
	8	Linear wave theory: wave celerity, length, and period, the sinusoidal wave profile, local fluid velocities and accelerations-concept	
	9	Water particle displacements, subsurface pressure, group velocity, wave energy and power-problem	
4	10	Wave propagation in shallow water, summary of linear wave theory- problem	CT/ Assignment/ Final Exam
	11	Changes in wave forms in coastal water	
	12	Coastal zone processes, coastal erosion	
5	13	Coastal sediment transport, sediment	

		transport theoretical models	
	14	Deltas, deltaic coasts, delta morphologies	
	15	Effects of sea level rise and subsidence on deltas, saving the deltas: the human-delta relationship	
6	16	Delta management plan	Mid Term/ Assignment/ Final Exam
	17	Storm surge, wind stress	
	18	Continental shelf, examples of surges-problem	
7	19	Tsunami: physical characteristics of tsunami, causes of tsunami	
	20	Tsunami: mitigation of risks and hazards, prediction and early warnings	
	21	Deep-ocean assessment and reporting of tsunamis	
8	22	Hydrodynamics and Sediment Dynamics of Tidal Inlets	
	23	Coastal-Offshore Ecosystem	
	24	Physics of Shallow Estuaries and Bays	
9	25	Estuarine Cohesive Sediment Dynamics	
	26	Offshore and Coastal Modelling	
	27	Harbour layout: Types, port terms, site selection, features	
10	28	Harbour planning and Layout	
	29	Types and function of coastal structures	
	30	Types and function of coastal structures	
11	31	Types and function of coastal structures	
	32	Typical cross section and layouts	
	33	Typical cross section and layouts (Contd.)	
12	34	Typical cross section and layouts (Contd.)	CT/ Assignment/ Final Exam
	35	Main type of armor units	
	36	Failure mode of typical structure types	
13	37	Design of shore protection works: introduction, purpose, applicability	
	38	Functional design of coastal structures	
	39	Design of coastal revetments	
14	40	Design of coastal sea walls	
	41	Design of coastal sea bulkheads	
	42	Environmental impacts of coastal structures	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO4	C2, C4
Final Exam	60%	CO2, CO3, CO5	C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Sorensen, R.M. (2006) Basic Coastal Engineering, 3rd Edition. Springer, 324pp.
2. Coastal Engineering Manual by Us Army Corps of Engineers (USACE).
3. Dock and Harbour Engineering (Second Edition) by Oza and Oza.
4. Coastal Engineering-2 by R Silverster.
5. Shore Protection Manual, U.S. Army Coastal Engineering Research Center.

6. Estuary and Coastline Hydrodynamics, A.T. Ippen (ed.): McGraw-Hill Book Co., Inc., 1966.

COURSE INFORMATION	
Course Code: EWCE 475	Credit Hour: 2.0
Course Title: Urban Hydrology	Contact Hour: 2.0

PRE-REQUISITE

EWC 363 (Hydrology)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This course will provide a detailed knowledge of the main processes in urban areas during rain events, design storms, losses, inlet systems, hydraulic calculus and CSO problems, and the tools to develop a project of a sewer system emphasizing the hydrologic and hydraulic behavior.

OBJECTIVE

1. Introduce the concept of Urban Drainage and the objectives associated to the drainage system
2. Introduce the main design criteria used in drainage systems.
3. Description of the different loss processes in urban environments.

COURSE CONTENT

Hydrologic cycle in urban environment, Urbanization and Stormwater Runoff, Rainfall and Runoff Analysis for Designing Urban Drainage Systems, Stormwater Drainage Structures, Stormwater Detention for Quantity Management, Urban Stormwater Pollution, Management Practices for Urban Stormwater Quality Control, Urban Stormwater Computer Models.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: **Understand** the natural factors that regulate hydrologic processes in urban areas.	√											
2	CO2: **Estimate** and regulate the use of surface water and groundwater resources.		√										
3	CO3: **Analyze** recent models on urban storm water management and sustainable urban drainage.		√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	**Understand** the natural factors that regulate	1	C2	1	–	1, 3	Assg/T, F

	hydrologic processes in urban areas.						
CO2	**Estimate** and regulate the use of surface water and groundwater resources.	2	C2	2	–	1, 4	T, M, F
CO3	**Analyze** recent models on urban stormwater management and sustainable urban drainage.	2	C4	1		1, 3	Assg/T, F
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning ● Lecture ● Practical/ Tutorial/ Studio ● Student – Centered Learning	 28 -- --
Self- Directed Learning ● Non-face-to-face learning ● Revision of the previous lecture at home ● Preparation for final examination	 05 10 32
Formal Assessment ● Continuous Assessment ● Final Examination	 02 03
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	1	Introduction: Hydrological Cycle	CT/ Assignment/ Final Exam
	2	Rainfall-runoff design methods	
2	3	Rainfall-runoff design methods	
	4	Unit hydrograph: theory and urban hydrology applications	
3	5	Unit hydrograph: theory and urban hydrology applications	
	6	Flood frequency: Introduction to frequency analysis and urban hydrology applications.	
4	7	Flood frequency: Introduction to frequency analysis and urban hydrology	

		applications.	CT/ Assignment/ Final Exam
	8	Hydraulics: Revision of basic principles	
5	9	Rainfall: Data needs and analysis	
	10	Storm weather: Quantities, estimation	
6	11	Storm weather: Design methods	Mid Term/ Assignment/ Final Exam
	12	Wastewater: Quantities, estimation	
7	13	Wastewater: Design methods	
	14	Combined sewers: Role, overflow	
8	15	Combined sewers: storage, urban pollution management	
	16	Flow & quality models: Current and recent models using in practice	
9	17	Storm weather management	
	18	Storm weather management	
10	19	Application for Watershed Scale Stormwater Management	
	20	Application for Watershed Scale Stormwater Management	
11	21	Sustainable urban drainage: Source control techniques	
	22	Sustainable urban drainage: Source control techniques	
12	23	Sustainable urban drainage: catchment models	CT/ Assignment/ Final Exam
	24	Sustainable urban drainage: catchment models	
13	25	Sustainable urban drainage: design approaches: small, medium, large.	
	26	Sustainable urban drainage: design approaches: small, medium, large.	
14	27	Review of Urban Hydrology	
	28	Review of Urban Hydrology	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C4
Final Exam	60%	CO1, CO2, CO3	C2, C4
Total Marks	100%		

REFERENCE BOOKS

1. Urban Hydrology, Hydraulics and Stormwater Quality, Akan and Houghtalen
2. Hormoz Pazwash. Urban Storm Water Management. CRC Press, 2011.
3. A Osman Akan, Robert J. Houghtalen. Urban Hydrology, Hydraulics, and
4. Stormwater Quality: Engineering Applications and Computer Modeling. New York: J. Wiley, 2003.
5. Kiran Tota-Maharaj. Permeable Pavements for Urban Stormwater Runoff
6. Enhancement and Reuse. VDM Verlag Dr. Müller, 2011.
7. Martin P. Wanielista, Yousef A. Yousef. Stormwater Management. New York: Wiley-Interscience, 1992

COURSE INFORMATION	
Course Code: EWCE 479	Credit Hour: 2.0
Course Title: Groundwater Hydrology	Contact Hour: 2.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will be able to learn the basics of 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. After this course they will have expertise on groundwater pollution and contaminant transport, recharge of groundwater, saline water intrusion in aquifers, groundwater management which will enhance their skills of designing coastal structures in professional life.

OBJECTIVE

1. To understand the basics of groundwater in hydrologic cycle and its occurrence, physical properties and principles of groundwater movement, groundwater and well hydraulics.
2. To understand and apply knowledge regarding groundwater resource evaluation, pollution and contaminant transport, recharge of groundwater, saline water intrusion in aquifers, groundwater management.

COURSE CONTENT

Physical properties and principles of groundwater movement, continuity equation and flow nets, hydraulics of pumping and recharging wells, pump test analysis, evaluation of aquifer properties, groundwater-surface water interactions, groundwater pollution and saline water intrusion, groundwater mining and land subsidence, groundwater exploration, modeling of aquifer systems.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: **Understand** the basics of groundwater in hydrologic cycle and its occurrence, physical properties and principles of groundwater movement, groundwater and well hydraulics.	√											
2	CO2: **Apply** knowledge regarding groundwater resource evaluation, pollution and contaminant transport, recharge of groundwater, saline water intrusion in aquifers, groundwater management		√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	**Understand** the basics of groundwater in hydrologic cycle and its occurrence, physical properties and principles of groundwater movement, groundwater and well hydraulics	1	C2	1	–	5	CT/ Assign ment-1
CO2	**Apply** knowledge regarding groundwater resource evaluation, pollution and contaminant transport, recharge of groundwater, saline water intrusion in aquifers, groundwater management	2	C3	1	–	3, 5	Mid Term/ Assign ment-2

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA=
Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge
Profile/ KP= Knowledge Profile
*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T – Test, PR – Project, Q – Quiz, M – Midterm Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face to Face Learning Lecture (2 hours/week x 14 weeks)	28
Guided Learning Tutorial/ Assignments (2 hours/week x 5 weeks)	10
Self- Directed Learning ● Non-face-to-face learning ● Revision of the previous lecture at home ● Preparation for final examination	22 15
Assessment Continuous Assessment Final examination	2 3
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Learning (PBL)

COURSE SCHEDULE

Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	1	Introduction to Groundwater Engineering	CT/ Assignment/

	2	Groundwater in hydrologic cycle and its occurrence	Final Exam
2	3	Groundwater in hydrologic cycle and its occurrence	
	4	Physical properties of groundwater movement	
3	5	Physical properties of groundwater movement	
	6	Principles of groundwater movement	
4	7	Principles of groundwater movement	Mid Term/ Assignment/ Final Exam
	8	Groundwater and well hydraulics	
5	9	Groundwater and well hydraulics	
	10	Groundwater and well hydraulics	
6	11	Groundwater and well hydraulics	Mid Term/ Assignment/ Final Exam
	12	Groundwater resource evaluation	
7	13	Groundwater resource evaluation	
	14	Groundwater level sand environmental influences	
8	15	Groundwater level sand environmental influences	
	16	Groundwater level sand environmental influences	
9	17	Water mining and land subsidence	
	18	Water mining and land subsidence	
10	19	Groundwater pollution and contaminant transport	
	20	Groundwater pollution and contaminant transport	
11	21	Recharge of groundwater	CT/ Assignment/ Final Exam
	22	Recharge of groundwater	
12	23	Recharge of groundwater	
	24	Saline water intrusion in aquifers	
13	25	Saline water intrusion in aquifers	
	26	Groundwater management	
14	27	Groundwater management	
	28	Groundwater management	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2	C2, C3
Final Exam	60%	CO1, CO2	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. "Groundwater Hydrology" by – Rushton
2. "Groundwater Engineering" by – Toad

COURSE INFORMATION	
Course Code: EWCE 477	Credit Hour: 2.0
Course Title: Climatology	Contact Hour: 2.0

PRE-REQUISITE

PHY 129

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

The course is aimed at providing an introduction to the physical processes underlying atmospheric and weather phenomena, including the climate system.

OBJECTIVE

1. To provide students with a basic understanding of meteorology and climatology.
2. Describe where energy comes from and trace its movement through the climate system
3. Students will be able to interpret the general characteristics of weather, and further to become familiar with the temporal and spatial representation of essential climate and meteorological variables
4. Meteorology topics include energy balance, moisture and cloud development in the atmosphere, atmospheric dynamics, small- and large-scale circulations, storms and cyclones, and weather forecasting.
5. Climatology topics include the interaction between the atmosphere and oceans over long time periods, climate classification, and the potential for climatic change.

COURSE CONTENT

Components and structure of climate Tsystem, Analysis of controls of the climate system (temperature and air pressure), The earth-atmosphere energy balance, atmospheric and ocean circulation, interaction of ocean and atmospheric processes, climatic zones and classification, climate models, climate variability and climate change, anthropogenic effects on climate-greenhouse warming, ozone layer depletion and sea level changes, extreme events of Bangladesh.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to **learn** the definition and characteristics of climate components as well as the radiation balance, atmospheric and ocean circulation, and interaction of ocean and atmospheric processes	√											
2	CO2: Be able to understand the temporal and spatial variation of earth’s climate with respect to human activities				√								

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to learn the definition	1	C1			1	Class Test,

	and characteristics of climate components, the radiation balance, atmospheric and ocean circulation, and interaction of ocean and atmospheric processes.						Final Exam
CO2	Be able to understand the temporal and spatial variation of earth's climate with respect to human activities.	4	C4			1, 2	Class Test, Mid Term Exam, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (2 hours/week × 14 weeks)	28
Guided Learning Tutorial/ Assignments (1 hours/week × 6 weeks)	6
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	10 11 20
Formal Assessment e) Continuous Assessment f) Final Examination	2 3
Total	80

TEACHING METHODOLOGY
Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction	CT 1
	02	Greenhouse effect	
2	03	Global warming	
	04	Climate	
3	05	Water vapor in a static atmospheric column	
	06	Perceptible water	
4	07	El Niño-Southern Oscillation (ENSO)	Mid Term Exam
	08	La Niña condition	
5	09	The Atmosphere and Climate	
	10	Climate zones	
6	11	Climate of Bangladesh	
	12	Layers of atmosphere	
7	13	Atmospheric circulation	
	14	Thermohaline circulation	
8	15	Ozone and Ozone layer	CT 2

	16	Ultraviolet radiation	
9	17	Ozone depletion	
	18	Ozone hole	
10	19	Antarctic ozone hole and Arctic ozone hole	
	20	Environmental effects of ozone depletion	
11	21	Air pollution and climate	CT 3
	22	Influence of meteorology and topography on air pollution	
12	23	Smog and photochemical smog	
	24	Acid Rain and effects of acid rain	
13	25	Hazards of Bangladesh	
	26	Flood and Drought	
14	27	GCM and RCM	
	28	Energy balance diagram	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2	C1, C4
Final Exam	60%	CO1, CO2	C1, C4
Total Marks	100%		

REFERENCE BOOKS

1. Physical Climatology (in greek), H. S. Sahsamanoglou and A. A. Bloutsos, Zitis Publications, Thessaloniki, Greece (1998).
2. Meteorology and Climatology courses (in greek), A. Flocas, Zitis Publications, Thessaloniki, Greece (1997).
3. Electronic notes, N. Hatzianastassiou (yearly updated).
4. Global Physical Climatology, D. L. Hartmann, Academic Press, San Diego, California, USA (1994).
5. Contemporary Climatology, A. Henderson-Sellers and P. J. Robinson, Longman Scientific & Technical, United Kingdom (1986). 6. Radiation and climate, I. M. Vardavas and F. W. Taylor, Oxford Science Publications, United Kingdom (2011)

COURSE INFORMATION	
Course Code: EWCE 481	Credit Hour: 2.0
Course Title: Climate Change and Disaster Management	Contact Hour: 2.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This course aims at supporting the global agenda of managing the risks associated to climate change through increased knowledge and awareness. It explores the inter- linkages between disaster risk management and climate change adaptation and outlines strategies, methods and tools for integrated climate risk management.

OBJECTIVE

1. To get better understanding of the implications of climate change for disaster risk management.
2. To improve the understanding of the impact of global climate change on weather- related hazards, such as floods, heat waves, droughts and storms.
3. To get acquainted with challenges for disaster risk management.

COURSE CONTENT
This course aims at supporting the global agenda of managing the risks associated to climate change through increased knowledge and awareness. It explores the inter- linkages between disaster risk management and climate change adaptation and outlines strategies, methods and tools for integrated climate risk management.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Ability to understand the causes and effects of climate change to deal with disaster management.	√											
2	CO2: Ability to explain environmental hazards, risk and vulnerability due.		√										
3	CO3: Ability to explain the principle of resilience, adaptation, mitigation and preparedness in response to disasters.				√								

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to understand the causes and effects of climate change to deal with disaster management Climatology and climate	1	C2	1	1	1	Test, Mid Term Exam, Final Exam
CO2	Ability to explain environmental hazards, risk and vulnerability due to repeated occurrences of climatic extreme events/ disasters.	2	C2	1	1,3	2	Class Test, Mid Term Exam, Final Exam
CO3	Ability to explain the principle of resilience, adaptation, mitigation and preparedness in response to disasters.	4	C3		1,3	1	Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile						

	*Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (2 hours/week × 14 weeks)	28
Guided Learning Tutorial/ Assignments (1 hours/week × 6 weeks)	6
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	9 18 46
Formal Assessment a) Continuous Assessment b) Final Examination	2 3
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction to weather, climate, climatic parameters	
	02	Introduction to natural and climate induced extreme events, disasters	
2	03	Concept on anomalies of climate events	
	04	Trend analysis on magnitude and frequency of climatic extremes/ disasters	
3	05	Concept on hazards, risk and vulnerability	CT 1
	06	Relationship between hazard, probability and risk	
4	07	Analysis on climate risk and vulnerability	
	08	Case studies on Environmental hazards	
5	09	Sensitivity to environmental hazards	Mid Term
	10	Climate change impacts on natural hazards	
6	11	Nature, sources, causes and impacts of Environmental hazards experienced in Bangladesh	
	12	Dimensions of Disaster: scale, vulnerability, Disaster trends	
7	13	History of natural disaster, Classification of natural disasters	
	14	Causes and impacts of natural disasters	
8	15	Vulnerability analysis: hazard assessment, resource requirement, defining an acceptable level of risk	
	16	Risk assessment: nature and assessment of risks	
9	17	Risk perception and management	
	18	Strategies and policy for integrated climate risk management	
10	19	Methods and tools used for integrated climate risk	

		management	
	20	Minimizing disaster loss: Environmental control, hazard resistance, preparedness with prior information, forecasting and warning technologies, land use planning	
11	21	Disaster mitigation measures: non-structural and structural mitigation	CT 2
	22	Case studies for experience and reduction of hazards: Seismic hazards – earthquakes, volcanoes	
12	23	Disaster management for mass movement hazards: landslides, avalanches	
	24	Disaster management for atmospheric hazards: cyclones, storms, tornadoes	
13	25	Disaster management for hydrological hazards: flood, drought	
	26	Disaster management for technological hazards: industrial accidents, oil spills	
14	27	Early warning systems for disaster preparedness in Bangladesh	
	28	Disaster management practices in Bangladesh	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2	C2
Final Exam	60%	CO1, CO2, CO3	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. Environmental Studies and Disaster Management, Resilience in Action: Challenges, and Solutions to Climate Change in Bangladesh by Samiya Selim, Basundhara Tripathy and Meherun Ahmed.
2. Handbook Of Disaster Risk Reduction & Management: Climate Change And Natural Disasters by Madu Christian N.)

COURSE INFORMATION	
Course Code: EWCE 483	Credit Hour: 2.0
Course Title: Building Services	Contact Hour: 2.0

PRE-REQUISITE

EWCE-331 (Water Supply Engineering), EWCE-333 (Waste Water Engineering and Sanitation)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This course introduces students to plumbing system – water supply, waste water drainage, storm drainage, house wiring, air conditioning, lift, generator, firefighting etc in a multistoried building. This will help the students to design the services in a building in their professional life.

OBJECTIVE

1. To learn about the major facilities/ services required for better living in buildings, especially in high rise buildings including plumbing, wiring and other electrical and mechanical installations.
2. To study and design of the necessary building services - water supply system, waste water and storm drainage system and water storage system.
3. To design rain water harvesting system, firefighting facilities etc.

COURSE CONTENT

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

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be skillful to **estimate** water requirement and **use** for various purposes in different types of building usage.	√											
2	CO2: Be able to **design** plumbing system for water supply, sewage and storm sewage, ventilation, fire-fighting, air conditioning.			√									
3	CO3: Be proficient to **understand** the design basics for lift installation, generator	√											
4	CO4: Be expert in **designing** rain water			√									

	harvesting system and other electrical and mechanical installations in buildings.												

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be skillful to **estimate** water requirement and **use** for various purposes in different types of building usage.	1	C3, C4	1, 3	–	2, 3	Class Test, Final Exam
CO2	Be able to **design** plumbing system for water supply, sewage and storm sewage, ventilation, fire-fighting, air conditioning.	3	C5	1,4, 5	–	5, 6	Mid-term, Final Exam
CO3	Be proficient to **understand** the design basics for lift installation, generator	1	C2	1	–	1, 2	Class Test, Mid-term, Assignment Final Exam
CO4	Be expert in **designing** rain water harvesting system and other electrical and mechanical installations in buildings.	3	C5	1,3,5	–	5, 6	Presentation, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)

Face-to-face Learning Lecture (3 hours/week × 14 weeks)	28
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	5 12 30
Formal Assessment • Continuous Assessment • Final Examination	2 3
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	1	Introduction to plumbing	
	2	Water requirements in a building	CT 1
2	3	Water requirements in a building (cont.)	
	4	Water supply and distribution in buildings	
3	5	Water supply and distribution in buildings (cont.)	
	6	Plumbing of multistoried buildings	
4	7	Design and construction of septic tanks	Mid Exam
	8	Design and construction of soak wells	
5	9	Design and construction of subsurface drain fields	
	10	Design and construction of septic tanks, soak wells and subsurface drain fields (cont.)	
6	11	House wiring	CT 2
	12	House wiring (cont.)	
7	13	Air conditioning (HVAC)	
	14	Air conditioning (HVAC) (cont.)	
8	15	Lift installation	
	16	Lift installation (cont.)	
9	17	Air handling unit, generator and other electrical and mechanical installations in building	
	18	Air handling unit, generator and other electrical and mechanical installations in building (cont.)	
10	19	Rain water harvesting unit	

	20	Rain water harvesting unit (cont.)	CT 3
11	21	Solar panel	
	22	Solar panel (cont.)	
12	23	Fire-fighting	
	24	Fire-fighting (cont.)	
13	25	Fire escape	
	26	Fire escape (cont.)	
14	27	Review of the total syllabus	
	28	Review of the total syllabus (cont.)	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C3, C5
Total Marks	100%		

REFERENCE BOOKS

6. Building services engineering – David V. Chadderton, 6th Ed.
7. Building services handbook – Roger Greeno, 7th Ed, Fred Hall

COURSE INFORMATION	
Course Code: EWCE 485	Credit Hour: 2.0
Course Title: Environmental Management System	Contact Hour: 2.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This course introduces students to environmental management system (EMS) requirements, standards, implementation steps, tools and techniques. This will help the students to apply EMS basics and requirement in designing as well as implementing projects in their professional life.

OBJECTIVE

- To make the students understand about requirements and steps of EMS
- To familiarize the students with various EMS models
- To learn about EMS standards, techniques and process tools.

COURSE CONTENT

Introduction to Management Systems, Requirements and Elements of Environmental Management Systems (EMS), The ISO 14001 EMS Model (Current and Proposed to High Level Structure), Scope and Applicability of ISO 14001 and ISO 14004, Purpose, Scope and Benefits of EMS Standards, EMS Implementation, General Requirements of ISO 14001, EMS Tools and Techniques, Housekeeping, Practical applications of EM.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)

		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to understand about requirements, standards and steps of EMS.	√											
2	CO2: Be able to **use** various EMS models		√										
3	CO3: Be able to **understand** and **apply** the concept of sustainable development in the use of EMS technologies.							√					

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP (WP)	CA (EA)	KP (WK)	Assessment Methods
CO1	Be able to **understand** about requirements, standards and steps of EMS.	1	C2	1	–	1	Class Test, Final Exam
CO2	Be able to **use** various EMS models	2	C4	1, 3	–	4	Class Test, Assignment, Final Exam
CO3	Be able to **understand** and **apply** the concept of sustainable development in the use of EMS technologies.	7	C3	1, 3	–	1	Presentation, Final Exam

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom's Taxonomy:

C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create

(T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	28
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	5 12 30
Formal Assessment • Continuous Assessment • Final Examination	2 3
Total	80

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	1	Introduction to Management Systems	
	2	Requirements of EMS	
2	3	Elements of EMS I	
	4	Elements of EMS II	
3	5	The ISO 14001 EMS Model I	
	6	The ISO 14001 EMS Model II	
4	7	Scope of ISO 14001 I	
	8	Applicability of ISO 14001	
5	9	Scope of ISO 14004 II	CT 1
	10	Applicability of ISO 14001	
6	11	Purpose, Scope and Benefits of EMS Standards I	
	12	Purpose, Scope and Benefits of EMS Standards II	
7	13	Purpose, Scope and Benefits of EMS Standards III	Mid-Term Exam
	14	Purpose, Scope and Benefits of EMS Standards IV	
8	15	EMS Implementation I	
	16	EMS Implementation II	
9	17	General Requirements of ISO 14001 I	
	18	General Requirements of ISO 14001 II	
10	19	EMS Tools I	CT 2
	20	EMS Tools II	
11	21	EMS Techniques I	
	22	EMS Techniques II	
12	23	Housekeeping I	
	24	Housekeeping II	
13	25	Practical applications of EMS I	

	26	Practical applications of EMS II	
14	27	Practical applications of EMS I	
	28	Practical applications of EMS II	

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3,	C2, C3, C4
Final Exam	60%	CO1, CO2, CO3	C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Environmental Management Systems- Christopher Sheldon, Mark Yoxon, 3rd Edition
2. Environmental Management Standards- Alan S. Morris, John Wiley & Sons, Ltd
3. Introduction to Environmental Management- Mary K. Theodore, Louis Theodore, CRC Press

5.2. Courses Offered by Department of Science and Humanities

COURSE INFORMATION	
Course Code: CHEM-103	Credit Hour: 3.0
Course Title: Fundamentals of Chemistry	Contact Hour: 3.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
To learn the basic concepts of inorganic, organic and physical chemistry	
OBJECTIVE	
1. To define the different parameter and concepts of inorganic chemistry. 2. To apply different chemical theory to evaluate structure of molecules. 3. To explain the basic concepts of physical chemistry. 4. To describe basic reaction mechanism of selective organic reactions.	
COURSE CONTENT	

Atomic Structure: Concepts of atomic structure, Different atom models, Quantum theory and electronic configurations, Heisenberg's uncertainty principle

Periodic Table: Periodic classification of elements, Periodic properties of elements, Properties and uses of noble gases

Chemical Bonding: Types and properties, Lewis theory, VBT, MOT, Hybridization and shapes of molecules.

Introduction to spectroscopic techniques: Interaction of electromagnetic radiation with matter, atomic spectroscopy, UV-Vis spectroscopy, Beer-Lambert law.

Fundamentals of chromatography: Basic principle, classification.

Acids-Bases/Buffer Solution: Different concepts of acids-bases, Buffer solution, Mechanism of buffer solution, Henderson-Hasselbalch equation, Water chemistry and pH of water Theories of Acid-Base Indicators.

Solutions: Solutions and their classification, Unit expressing concentration, Colligative properties and dilute solutions, Raoult's law, Van't Hoff's law of osmotic pressure.

Thermochemistry: Laws of thermochemistry, Enthalpy, Hess's law, Heat of formation, Kirchoff's equations, Heat of neutralization, Heat of reaction.

Electrochemistry: Conductors & nonconductors, Difference between electrolytic and metallic conduction, Electrolytic conductance, Factors influencing the conductivity of electrolytes, Kohlrausch Law & conductometric titrations.

Chemical Equilibria: Equilibrium law/constant, Kp and Kc, Homogeneous and heterogeneous equilibrium, Van't Hoff's reaction isotherm, Le Chatelier's principle.

Chemical Kinetics: Order and rate of reaction, Pseudo and zero order reaction, Half-life, Determination and factors affecting the rate of a reaction, First order reaction, Second order reaction, Collision theory, Transition state theory.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to define/identify the different parameters and fundamental concepts regarding inorganic and	√											

	physical chemistry, analytical chemistry.												
2	CO2: Be able to apply different theories on chemical bonding and hybridization to analyze the structure of molecules.	√											
3	CO3: Be able to explain/illustrate /derive different theories based on colligative properties, chemical equilibrium, chemical kinetics, thermochemistry and electrochemistry, spectroscopic techniques.	√											
4	CO4: Solve/Analyze different problems related to inorganic and physical chemistry	√											

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to define/identify the different parameters and fundamental concepts regarding inorganic and physical chemistry, analytical chemistry.	1	C1	-	-	1	Class Test, Final Exam
CO2	Be able to apply different theories on chemical bonding and hybridization to analyze the structure of molecules.	1	C3, C4	-	-	1,2	Class Test, Final Exam, Assignment
CO3	Be able to explain/illustrate /derive different theories based on colligative properties, chemical equilibrium, chemical kinetics, thermochemistry and electrochemistry,	1	C2	-	-	1,2	Assignment, Class Test, Mid Term, Final Exam

	spectroscopic techniques						
CO4	Solve/Analyze different problems related to inorganic and physical chemistry	2	C4, C5	-	-	1,2	Class Test, Assignment, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember; C2 – Understand; C3- Apply; C4 – Analyze; C5 - Evaluate; C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture • Class Performance	 42 -
Self- Directed Learning • Assignments • Revision of the previous lecture at home • Preparation for final examination	 36 18 18
Formal Assessment g) Continuous Assessment h) Final Examination	 2 3
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	General introduction on the importance of chemistry for EWCE students, Concepts of atomic structure	CT 1
	02	Different atom models	
	03	Quantum numbers, Electronic configuration	
2	04	Hydrogen spectral lines, Heisenberg's uncertainty principle	
	05	Classification of elements according to electronic configurations	
	06	Periodic classification of elements	
3	07	Periodic properties of elements, Properties and uses of noble gases	
	08	Alkali metals: Chemical properties and uses	
	09	Chemical bonding (types, properties, Lewis theory, VBT)	
4	10	Molecular orbital theory (MOT)	
	11	Molecular orbital theory (MOT)	

	12	Hybridization and shapes of molecules	CT-2
5	13	Hybridization and shapes of molecules	
	14	Hybridization and shapes of molecules	
	15	Interaction of electromagnetic radiation with matter, Atomic Spectroscopy-basic principle	
6	16	Atomic Spectroscopy	
	17	UV-Vis spectroscopy	
	18	UV-Vis spectroscopy, Beer-Lambert law	
7	19	Chromatography basic principle	CT-3/Mid Term
	20	Chromatography classification	
	21	Different concepts of acids-bases, Water chemistry and pH of water	
	22	Different concepts of acids-bases, Water chemistry and pH of water	
	23	Buffer solution, Mechanism of buffer solution, Henderson-Hasselbalch equation. Theories of Acid-Base Indicators	
	24	Effect of temperature and pressure on solubility, Validity and limitations of Henry's law	
9	25	Colligative properties and dilute solutions, Raoult's law, deviation from Raoult's law, Elevation of boiling point	
	26	Freezing point depression, Van't Hoff's law of osmotic pressure	
	27	Thermochemistry: Laws of thermochemistry, Enthalpy	
10	28	Hess's law, Kirchoff's equations	
	29	Heat of formation, Heat of neutralization, Heat of reaction	
	30	Electrolytic conduction and its mechanism	
11	31	Faraday's law, Kohlrausch Law, Debye-Huckel-Onsagar theory	CT-4
	32	Conductometric titrations	
	33	Different types of cells	
12	34	Reversible reactions, Characteristics of chemical equilibrium, Law of mass action, Equilibrium constant, Units of equilibrium constant	
	35	Relation between Kp & Kc,Van't Hoff's reaction isotherm	
	36	Free energy and its significance Heterogeneous equilibrium, Le Chatelier's principle	
13	37	Temperature dependence on the equilibrium constant	
	38	Phase Diagram of water and carbon dioxide	
	39	Pseudo and zero order reaction, Half-life	
14	40	Determination and factors affecting the rate of a reaction	
	41	First order reaction, Second order reaction	
	42	Collision theory, Transition state theory	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment	40%	CO1, CO2, CO3,	

(Class assignments/ CT/ Mid Term/ Active Class Participation)		CO4	C1, C2, C3, C4, C5
Final Exam	60%	CO1, CO2, CO3, CO4	C1, C2, C3, C4, C5
Total Marks	100%		

REFERENCE BOOKS

1. Modern Inorganic Chemistry – S. Z. Haider
2. Concise Inorganic Chemistry – J. D. Lee
3. Analytical Chemistry- G.D. Christian
4. Principles of Physical Chemistry – Haque and Nawab
5. Essentials of Physical Chemistry – Bahl and Tuli
6. Physical Chemistry – Atkins

COURSE INFORMATION	
Course Code: CHEM 104	Credit Hour: 1.5
Course Title: Chemistry Sessional	Contact Hour: 3.0
PRE-REQUISITE	
Course Code: N/A	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
To implement the basic concepts of inorganic and physical chemistry in a laboratory environment.	

OBJECTIVE

1. To familiarize the students with experimentation of acid and base neutralization, titration and quantitative analysis of metals etc.
2. To make students proficient in iodimetric and iodometric analysis and complexometric titration etc.
3. To develop students' ability in estimating zinc, ferrous content in water sample by using various titrimetric methods, and UV-Vis spectrophotometric method.

COURSE CONTENT

Quantitative chemical analysis in the field of inorganic and physical chemistry such as:
Acid-base titration, Redox titration, Iodometric and Iodimetric titration, Complexometric titration.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to describe the different parameters regarding acid and base neutralization, titration and quantitative analysis of metals etc. and others key words like primary standard substances, secondary standard substances, molarity, normality, indicator, equivalent weights and so on.	√											
2	CO2: Be able to explain the different phenomena and perform experimentation regarding iodimetric and iodometric method, complexometric titration, UV-Visspectrophotometric method, etc.	√				√					√		
3	CO3: Be able to measure copper, ferrous content in water sample by using	√				√					√		

	various titrimetric methods and spectrophotometric methods.												

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to describe the different parameters regarding acid and base neutralization, titration and quantitative analysis of metals etc. and others key words like primary standard substances, secondary standard substances, molarity, normality, indicator, equivalent weights and so on.	1	C1	-	–	1,2	Quiz, Report, Test
CO2	Be able to explain the different phenomena and perform experimentation regarding iodimetric and iodometric method, complexometric Titration, UV-Vis spectrophotometric method etc.	1,5,10	C2, C3, C4, C5	-	–	1,2	Quiz, Report, Test
CO3	Be able to measure copper, ferrous content in water sample by using various titrimetric methods, spectrophotometric method.	1,5,10	C3, C4, C5	-	–	1,2	Project, Quiz, Report, Test
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom’s Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture • Experiment	 12 30
Self-Directed Learning a) Preparation of Lab Reports b) Preparation of Lab-test c) Preparation of Quiz	 2 2 3
Formal Assessment i) Continuous Assessment j) Quiz and viva	 10 1
Total	60
TEACHING METHODOLOGY	
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method	
COURSE SCHEDULE	

Week	Lecture	Topics to be Covered	Assessment
1	01	Introduction	Assignment, Quiz, Report
2	02	Standardization of Sodium Hydroxide (NaOH) Solution with Standard Oxalic Acid dihydrate (C2H2O4.2H2 O) Solution.	
3	03	Standardization of Hydrochloric Acid (HCl) Solution with Standard Sodium Hydroxide (NaOH) Solution.	
4	04	Standardization of Hydrochloric Acid (HCl) Solution with Standard Sodium Carbonate (Na2 CO3) Solution.	
5	05	Determination of Calcium (Ca) Content in a Calcium Chloride dihydrate (CaCl2.2H2 O) Solution with Standard Di-Sodium Ethylene DiammineTetraAceticAcid (Na2-EDTA) Solution	
6	06	Standardization of Sodium ThiosulphatePentahydrate (Na2S2O3.5H2 O) Solution with Standard Potassium Dichromate (K2Cr2O7) Solution	
7	07	Estimation of Copper (Cu) Content in a Copper SulphatePentahydrate (CuSO4)	
8	08	Standardization of Potassium Permanganate (KMnO4) Solution with Standard Oxalic Acid dihydrate (C2 H2 O4 .2H2 O) Solution.	
9	09	Sulphate (Mohr`s Salt) [FeSO4.(NH4)2SO4.6H2O] Solution with Standard Potassium Permanganate (KMnO4)) Solution.	
10	10	Spectroscopic determination of iron (Ii) by complexing with 1,10-phenanthroline.	
11	11	Practice Lab	

12	12	Lab Test	
13	13	Quiz Test	
14	14	Viva	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Assignment/Test/ Mid Term/ Active Class Participation)	70%	CO1, CO2, CO3	C1, C2, C3, C4, C5
Quiz	30%	CO1, CO2, CO3	C1, C2, C3, C4, C5
Total Marks	100%		

REFERENCE BOOKS

1. G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, 5th Edition, Longman Scientific & Technical, 1989
2. G. D. Christian., Analytical Chemistry, 6th Edition, Wiley India Pvt. Limited, 2007
3. A. Jabbar Mian and M. Mahbubul Haque-Practical Chemistry4. Bear and Johnson.

COURSE INFORMATION	
Course Code: PHY 129	Credit Hour: 3.0
Course Title: Waves and Oscillations, Optics, and Structure of Matter	Contact Hour: 3.0

PRE-REQUISITE

N/A

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This course is the basic physics in the field of waves and oscillations, structure of matter and thermodynamics and hydrodynamics. The course will be emphasized the basic concepts, theories, and solve quantitative problems which can be applicable in a wide spectrum of engineering disciplines.

OBJECTIVE

1. To define the different parameters, concepts, logical and critical thinking with scientific knowledge of waves and oscillations, optics, and structure of matter.
2. To explain the basic theories and laws of waves and oscillations, optics, and structure of matter.
3. To solve numerical and analytical problems regarding waves and oscillations, optics, and structure of matter.

COURSE CONTENT

Waves and Oscillations: Simple Harmonic Motion (SHM) and its properties, differential equation of a SHM and its solution, total energy and average energy of a body executing SHM, simple pendulum, torsional pendulum, spring-mass system, LC oscillatory circuit, two body oscillation and reduced mass, Composition of SHM, Damped oscillations, and its different condition, forced oscillations and its different condition, resonance, Wave motion : expression for a plane progressive wave, differential equation of wave motion, energy density of wave motion, average kinetic and potential energy of wave motion, Stationary wave.

Optics: Combination of lens, equivalent lens and power, Defects of images and different aberrations, Interference of light, Young's double slit experiment, interference in thin films, Newton's ring, Diffraction of light, Fraunhofer and Fresnel diffraction, diffraction by single slit and double slit, diffraction grating, Fraunhofer diffraction at a circular aperture, resolving power of optical instrument, Polarization of light, Brewster's law, Malus law, polarization by double refraction, Nicole prism, optical activity and polarimeters, Laser: spontaneous and stimulated emission.

Structure of matter : Crystalline and non-crystalline solids, single crystal and poly-crystal solids, unit cell, crystal systems, co-ordinations number, crystal planes and directions, NaCl and CsCl structure, packing factor, Miller indices, relation between inter-planar spacing and Miller indices, Bragg's law, methods of determination of inter-planar spacing from diffraction patterns; defects in solids: point defects, line defects, surface defects, bonds in solids, band theory of solids: distinction between metal, semiconductor and insulator, inter-atomic distances, calculation of cohesive and bonding energy.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to Define different basic parameters in the field of waves and oscillations, optics, and structure of matter such as	√											

	periodic motion, simple harmonic motion, undamped oscillations, interference, diffraction, polarization, crystal structure, crystal defects etc.												
2	CO2: Be capable to Explain different basic theories in the field of waves and oscillations, optics, and structure of matter such as the wave motion for different systems along with energy, different formula for interference, diffraction, polarization, the packing factor, Bragg's law, etc.	√											
3	CO3: Be skilled to Solve quantitative problems in the field of waves and oscillations, optics, and structure of matter such as energy of wave motion, wavelength, interference, diffraction, polarization, packing factor, Miller indices, etc.	√											

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Define different basic laws and parameters in the field of waves and oscillations, optics, and structure of matter such as simple harmonic motion, damped oscillations, interference, diffraction, polarization, crystal structure, crystal defects, etc.	1	C1	-	-	1	Class Test, Mid-term, Final Exam
CO2	Explain different basic theories in the field of waves and oscillations, optics, and structure of matter such as the SHM, damped motion, wave	1	C2	-	-	1	Class Test, Mid-term, Final Exam

	motion, interference, diffraction, polarization, Bragg's law, bonding energy, etc.						
CO3	Solve quantitative problems in the field of waves and oscillations, optics, and structure of matter such as SHM, damped motion, wave motion, interference, diffraction, polarization, packing factor, Miller indices, etc.	1	C3	-	-	2	Assignment, Class Test, Mid Term, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember, C2 – Understand, C3- Apply, C4 – Analyze, C5 - Evaluate, C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture • Practical / Tutorial / Studio • Student-Centered Learning	42 - -
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for test and examination	36 18 18
Formal Assessment a) Continuous Assessment b) Final Examination	3 3
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introductory class: Brief discussion on total syllabus, basic requirements of the course,	

		assessment of the course	
	02	Periodic motion, oscillatory motion, simple harmonic motion (SHM), properties of SHM, differential equations, general solution of SHM, graphical representation of SHM	
	03	Velocity, acceleration, phase and epoch, time period, frequency and angular frequency of SHM	CT-1/Assignment
2	04	Total energy and average energy of SHM, problems	
	05	Simple pendulum, torsional pendulum, spring-mass system	
	06	LC oscillatory circuit, two body oscillations, reduced mass	
3	07	Composition of SHM	
	08	Composition of SHM, problems	
	09	Damped oscillations and its differential equation	
4	10	Displacement equation of damped oscillations and its different conditions, electric damped oscillatory circuit	
	11	Forced oscillations and its differential equation, displacement equation of forced oscillations, resonance	
	12	Wave motion : expression for a plane progressive wave, differential equation of wave motion, particle velocity, wave velocity	
5	13	Energy density of a plane progressive wave, average energy in a plane progressive wave, problems	CT-2/Assignment
	14	Stationary wave : node, anti-node, problems	
	15	Lens and combination of lenses, equivalent lens, power of lens, cardinal points	
6	16	Defects of images and different aberrations	
	17	Defects of images and different aberrations	
	18	Interference of light, young's double slit experiment	
7	19	Analytical treatment of interference, energy distribution	
	20	Interference fringes, interference in thin films	
	21	Newton's ring, Interferometer	
	22	Diffraction : Fresnel & Fraunhofer diffraction, diffraction by single slit	
	23	Diffraction by double slit, diffraction gratings	
	24	Fraunhofer diffraction at a circular aperture, resolving power of optical instrument	
9	25	Polarization of light, Brewster's law, Malus' law	Mid Term/Assignment
	26	Polarization by double refraction, Nicol prism: Polarizer and analyzer	
	27	Optical activity: specific rotation, polarimeters	
10	28	Laser: spontaneous and stimulated emission, applications of laser	
	29	Classification of solids, types of crystalline solids, crystal, lattice, basis, crystal structure, plane lattice, space lattice, Bravais and non-Bravais lattices	

	30	Unit cell, lattice parameters, primitive and non-primitive cells and their distinctions, lattice symbols, crystal structure of NaCl and CsCl	
11	31	Unit face, axial units: linear and numerical parameters and, Miller indices	CT-3/Assignment
	32	Atomic radius, packing factor and coordination number for different structures	
	33	Relation between lattice constant and density of solids and related numerical problems	
12	34	Inter-planer spacing, relation between inter-planar spacing and Miller indices, problems	
	35	X-ray diffraction, Bragg's law, methods of determination of inter-planar spacing from diffraction patterns, problems	
	36	Defects in solids: point defects, line defects, surface defects	
13	37	Defects in solids: point defects, line defects, surface defects	
	38	Atomic arrangement in solid: different types of bonds in solids	
	39	Band theory of solids : valence band, conduction band, energy gap, distinction between metal, semiconductor and insulator	
14	40	Potential, cohesive energy, binding energy, Madelung constant, inter-atomic distance, calculation of total potential energy of a pair of atoms	
	41	Calculation of total potential energy at the equilibrium separation of an ionic crystal, problems	
	42	Review of the syllabus	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C3
Final Exam	60%	CO1, CO2, CO3	C1, C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. Physics for Engineers : Part-I and Part-II : Dr Giasuddin Ahmad
2. Physics, Volume I and Volume II : Resnick and Halliday
3. Fundamentals of Physics : Halliday, Resnick and Walker
4. Physics for Scientists and Engineers: Serway and Jewett
5. Waves and Oscillations : Brij Lal and Subramannyam
6. Fundamental of Optics: Francis A. Jenkins and Harvey E.White
7. Introduction to Modern Optics: Grant R. Fowles
8. Fundamental Optical Design: Michael J. Kidger
9. A Text Book of Optics : Brijlal and N. Subrahmanyam
10. Introduction to Solid State Physics: Charles Kittle
11. Solid State Physics: S. O. Pillai
12. Solid State Physics: Ali Omar
13. Fundamentals of Solid State Physics : B.S. Saxena, R.C. Gupta, P.N. Saxena

14. B.Sc Physics : C. L. Arora.

COURSE INFORMATION	
Course Code: PHY 130	Credit Hour: 1.5
Course Title: Physics Sessional	Contact Hour: 3.0
PRE-REQUISITE	
N/A	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
This is a laboratory course in basic physics in the fields of waves and oscillations, optics, mechanics, electricity, modern physics, and thermal physics. The course will emphasize the fundamental experiments in different fields of physics that can be applicable to a wide spectrum of engineering disciplines. This laboratory course will enable students to understand basic physics practically as well as work with a team or individual.	
OBJECTIVE	
1. To develop basic physics knowledge practically 2. To practice use of basic scientific instrument	
COURSE CONTENT	
Quantitative measurement of different parameters in the field of waves and oscillations, optics, mechanics, electricity, modern physics and thermal physics such as: Specific resistance of materials, high resistance, resistance of a galvanometer, Electrochemical equivalent (ECE) of copper, comparison of the E.M.F's of two cells, radius of curvature, wavelength of light, focal length of lens, specific rotation of sugar, refractive index of a liquid, thermal conductivity of a bad conductor, temperature co-efficient of resistance, pressure co-efficient of a gas, specific heat of a liquid, acceleration due to gravity, spring constant, rigidity modulus, young's modulus, moment of inertia, conservation of linear momentum, frequency of a tuning fork, surface tension, Planck's constant.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to Define the different parameters regarding waves and oscillations, optics, mechanics, electricity, modern physics and thermal physics etc.	√											
2	CO2: Be capable to Describe the different phenomena regarding waves and oscillations,	√											

	optics, mechanics, electricity, modern physics and thermal physics etc.												
3	CO3: Be skilled to Construct Experiments by an individual or by a group to determine different phenomena regarding waves and oscillations, optics, mechanics, electricity, modern physics and thermal physics etc.	√											
4	CO4: Be able to Prepare a report for an experimental work.	√											

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Define the different parameters regarding waves and oscillations, optics, mechanics, electricity, modern physics and thermal physics etc.	1	C1			1	Quiz, Report, Final Exam
CO2	Describe the different phenomena regarding waves and oscillations, optics, mechanics, electricity, modern physics and thermal physics etc.	1	C1			1	Test, Quiz, Report, Final Exam
CO3	Skilled to Construct Experiments by an individual or by a group to determine different phenomena regarding waves and oscillations, optics, mechanics, electricity, modern physics and thermal physics etc.	1	C2			2	Test, Quiz, Report, Final Exam
CO4	Prepare a report for an experimental work.	1	C2			2	Report

	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 12 weeks)	36
Guided Learning Tutorial/ Assignments (1 hours/week × 12 weeks)	12
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	1 2 3
Formal Assessment a) Continuous Assessment b) Quiz and viva	2 4
Total	60
TEACHING METHODOLOGY	
Lecture and Discussion, Problem Based Method	

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introductory class: Brief discussion on total syllabus, basic requirements of the course, evaluation system of the course, grouping, visit different section of the laboratory, introduction to different basic equipment	Perform any one
2	02	Determination of the specific resistance of a wire using meter bridge / Determination of focal length of a concave lens by auxiliary lens method	Perform any one
3	03	Determination of high resistance by the method of deflection / Determination of resistance of a galvanometer by half deflection method / Determination of specific heat of a liquid by the method of cooling	Perform any one

4	04	Determination of ECE of copper by using copper voltameter / Determination of the Young's modulus of bar by bending method. / Determination of the Young's modulus for the material of a wire by Searle's apparatus	Perform any one
5	05	Determination of the wavelength of sodium light by a spectrometer using a plane diffraction grating/ Determination of the moment of inertia of a Fly-wheel about its axis of rotation.	Perform any one
6	06	Determination of the radius of curvature of a plano-convex lens by Newton's ring method/ Determination of the temperature co-efficient of resistance of the material of a wire using a meter-bridge	Perform any one
7	07	Determination of the specific rotation of sugar by polarimeter/ Determination of the refractive index of a liquid by plane mirror and pin method using a convex lens	Perform any one
8	08	Determination of the thermal conductivity of a bad conductor by Lee's method / Verification of the law of conservation of linear momentum / Determination of the surface tension of water by capillary tube method and hence to verify Jurin's law.	Perform any one
9	09	Determination of the value of g acceleration due to gravity by means of a compound pendulum / Comparison of the E.M.F's of two cells by a potentiometer.	Perform any one
10	10	Determination of the spring constant, effective mass and the rigidity modulus of the spring / Determination of the pressure co-efficient of a gas at constant volume by constant volume air thermometer.	Perform any one
11	11	Determination of the Planck's constant using photoelectric effect / Determination of the frequency of a tuning fork by Melde's experiment	Perform any one
12	12	Viva & lab final experimental exam	
13	13	Viva & lab final experimental exam	
14	14	Quiz exam	Quiz

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Assignment/Test/ Mid Term/ Active Class Participation/Report)	70%	CO1, CO4	C1, C2
Quiz	20%	CO1, CO2, CO3	C1, C2
Viva	10%		
Total Marks	100%		

REFERENCE BOOKS

1. Practical physics for degree students : Dr Giasuddin and Md. Sahabuddin
2. Practical Physics: G. L. Squires
3. B.Sc. Practical Physics: C. L Arora
4. Practical Physics: S.L. Gupta and V. Kumar

COURSE INFORMATION	
Course Code: Math 101	Credit Hour: 3.0
Course Title: Differential and Integral Calculus	Contact Hour: 3.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
Purpose of this course is to introduce knowledge of Calculus and use it to engineering study.	
OBJECTIVE	
1. Be able to acquire knowledge on differential and integral calculus to solve engineering problems and other applied problems. 2. Be able to understand the important aspects of rate of change, tangent, normal, area and volume. 3. Be expert in applying knowledge of functional analysis such as increasing, decreasing, maximum and minimum values of a function.	
COURSE CONTENT	
Differential Calculus: Introduction, differential calculus for engineering, continuity and differentiability of functions, differentiation of various functions, successive differentiation, Leibnitz's theorem, Rolle's theorem, Mean-value theorem, expansion of functions, partial differentiation, Euler's theorem, tangent and normal, maxima and minima, curvature, asymptotes. **Integral Calculus:** Definition of integration, various techniques of integration , integration by substitution, standard integrals, integration by parts, integration by successive reduction, definite integrals, Walli's formula, integration as a limit of sum, improper integrals, Beta and Gamma functions, multiple integral, lengths of curves, area of the region enclosed by two curves, volume of solid of revolution.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Define limit, continuity and differentiability of functions, identify rate of change of a function with respect to independent variables and describe different techniques of evaluating indefinite and definite integrals.	√											
2	CO2: Apply concepts and techniques of differentiation and integration to solve	√											

	the problems related to engineering study.												
3	CO3: Calculate length, area, volume, average value related to engineering study.	√											

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Define limit, continuity, differentiability of functions, rate of change of a function with respect to independent variables, the extremum value of functions.	1	C1	1	-	3	Class Test, Final Exam, Assignment
CO2	Apply the concepts and techniques of differentiation and integration to solve the problems related to engineering study.	1	C3	1	--	3	Class Test, Mid-term, Final Exam
CO3	Calculate length, area, volume and average value related to engineering measurement.	1	C3	1		3	Assignment, Mid Term, Final Exam

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom’s Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 25 21 21
Formal Assessment a) Continuous Assessment b) Final Examination	 8 3

Total	120

TEACHING METHODOLOGY			
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method			
COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction to differential calculus for engineering study, limit of a function and its properties.	CT1
	02	Basic limit theorems with proofs, limit at infinity and infinite limit, Sandwich (Squeezing) theorem with problems.	
	03	Concept of differentiation, definition, classification of discontinuity and solution of problems	
2	04	Basic concept of differentiability, definition, derivative of a function, differentiable function.	
	05	Differentiability – one sided derivatives (R.H.D and L.H.D), solving problems	
	06	Successive differentiation – Concept and problem solving	
3	07	Leibnitz's theorem and its applications	
	08	Determination of (y_n)_0	
	09	Mean Value theorem	
4	10	Taylor theorem	CT 2
	11	Indeterminate forms – concept and problem solving,	
	12	L'Hospital's rul	
5	13	Partial differentiation - partial derivatives of a function of two variables and problems	
	14	Partial differentiation - partial derivatives of homogeneous function of two variables, Euler's theorem for two variables and problems	CT 3
	15	Partial differentiation - partial derivatives of a homogeneous function of several variables, Euler's theorem for several variables and problem solving	
6	16	Tangents and Normals – Tangents and Normals in Cartesian, equation of tangent at the origin, equation of normal of functions of explicit and implicit forms, Angle between two intersection of two curves; problem solving	
	17	Tangents and Normals – Tangents and Normals in Cartesian, equation of tangent at the origin, equation of normal of functions of explicit and implicit forms, Angle between two intersection of two curves; problem solving	
	18	Tangents and Normals – Tangents and Normals in Cartesian, equation of tangent at the origin, equation of normal of functions of explicit and implicit forms, Angle between two intersection of two curves; problem solving	
7	19	Maxima and minima of functions of single variables: concept, increasing and decreasing function, concave up and concave down functions	Mid Term
	20	Curvature	
	21	Asymptotes	
	22	Introduction to integral calculus	

	23	Standard integrals : concept of definite and indefinite integrals, applications.	
	24	Indefinite integrals :Method of substitution, various techniques of integration	
9	25	Indefinite integrals : Integration by parts, special types of integration, integration by partial fraction	
	26	Integration by the method of successive reduction	
	27	Definite integrals : definite integrals with properties and problems	
	28	Definite integrals : Reduction formula, Walli's formula	CT 4
	29	Definite integrals : Definite integral as the limit of sum	
	30	Beta function :Concept and solution of problems	
11	31	Gamma function : Concept and problem solving	
	32	Relation between Beta and Gamma functions, Legendre duplication formula, problems and applications	
	33	Multiple integrals :Double integrals	
12	34	Multiple integrals :Triple integrals	
	35	Multiple integrals : Successive integration for two and three variables	
	36	Arc lengths of curves in Cartesian coordinate	
13	37	Arc lengths of curves in polar coordinates and parametric curves	
	38	Area in Cartesian co-ordinate	
	39	Area under a plain curve in Cartesian and polar coordinates	
14	40	Area of a region enclosed by two curves in Cartesian and polar coordinates	
	41	Volume of solid of revolution	
	42	Volume of solid of revolution	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C3
Final Exam	60%	CO1, CO2, CO3	C1, C2, C3
Total Marks	100%		

TEXT BOOKS

1. Calculus by Howard Anton, Irl C. Bivens, Stephen Davis
2. Differential Calculus (Part I-II) by Dr Md Abdul Matin and Bidhu Bhushan Chakraborty
3. Integral Calculus and Differential Equation by Md Abdul Matin and Bidhu Bhushan Chakraborty

REFERENCE BOOKS

1. Calculus: An Intuitive and Physical Approach by Morris Kline
2. Differential Calculus by B.C. Das and B.N. Mukherjee
3. Integral Calculus by B.C. Das and B.N. Mukherjee

COURSE INFORMATION	
Course Code: Math 103	Credit Hour: 3.0
Course Title: Differential Equations and Matrix	Contact Hour: 3.0

PRE-REQUISITE

MATH 101 (Differential and Integral Calculus)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

Purpose of this course is to introduce knowledge to solve differential equations and apply them to solve engineering problems. Also to acquire knowledge on matrix, formulate the engineering problems in matrix form and solve them.

OBJECTIVE

1. Be able to acquire knowledge on ordinary and partial differential equations.
2. Be able to understand important aspects of ordinary & partial differential equations and be able to solve them.
3. Be able to apply differential equations and matrices in solving engineering problems.

COURSE CONTENT

Differential Equations: Introduction & formulation of differential equations, solution of first order ordinary differential equations by various methods, application of first order differential equations, solution of ordinary differential equations of higher order, solution of Euler's homogeneous linear ordinary differential equations, Frobenious methods, Bessel's functions, Legendre's polynomial, linear first order partial differential equations, nonlinear first order partial differential equations, standard form differential equations of higher order and wave equation, particular solutions with boundary and initial condition, linear partial differential equations with constant coefficients, non-linear partial differential equations of order one, Charpit's method, Applications of partial differential equations.

Matrix: Different types of matrices, transpose, adjoint of a matrix, inverse matrix, rank of matrix, elementary transformation, matrix algebra, solution of system of linear equations, matrix polynomials, eigen-value and eigen-vector, Cayley Hamilton theorem.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Define various types of differential equations and identify the classifications of ordinary and partial differential equations to solve engineering problems.	√											
2	CO2: Apply the knowledge to solve ordinary and partial differential equations.	√											
3	CO3: Apply various operations of matrices to formulate engineering problems and solve them.	√											

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods

CO1	Define various types of differential equations and matrices.	1	C1	1	-	3	Class Test, Final Exam, Assignment
CO2	Apply the knowledge of differential equations and matrices to solve the engineering problems	1	C3	1	-	3	Class Test, Mid-term, Final Exam
CO3	Apply the various operations of matrices to to formulate engineering problems and solve them.	1	C3	1	-	3	Assignment, Mid Term, Final Exam

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R – Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self- Directed Learning	
• Non-face-to-face learning	25
• Revision of the previous lecture at home	21
• Preparation for final examination	21
Formal Assessment	
a) Continuous Assessment	8
b) Final Examination	3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction & formulation of differential equations, degree and order of differential equations	CT1
	02	Introduction & formulation of differential equations, degree and order of differential equations	
	03	Introduction & formulation of differential equations, degree and order of differential equations	
2	04	Solution of first order differential equations by various methods	
	05	Solution of first order differential equations by	

		various methods	
	06	Solution of first order differential equations by various methods	
3	07	Application of first order ordinary differential equations in Malthusian population model	
	08	Application of first order ordinary differential equations in Newton's cooling law	
	09	Application of first order ordinary differential equations in electrical circuit.	
4	10	Application of first order ordinary differential equations in trajectory.	CT2
	11	Solution of higher order differential equations	
	12	Solution of higher order differential equations	
5	13	Solution of higher order differential equations	
	14	Solution of higher order differential equations	
	15	Solution of higher order differential equations by method of variation of parameter	
6	16	Formation of partial differential equation	
	17	Linear first order PDE, Nonlinear first order PDE	
	18	Particular solutions with boundary and initial condition, Non-linear PDE of order one: Charpit's method	
7	19	Linear PDE with constant coefficients, Applications of DE	Mid Term Exam
	20	Linear PDE with constant coefficients, Applications of DE	
	21	Linear PDE with constant coefficients, Applications of DE	
8	22	Wave equations	
	23	Particular solutions with boundary and initial conditions	
	24	Particular solutions with boundary and initial conditions	
9	25	Second order PDE and classifications to canonical (standard)-parabolic, elliptic, hyperbolic solution by separation of variables,	
	26	Second order PDE and classifications to canonical (standard)- parabolic, elliptic, hyperbolic solution by separation of variables,	
	27	Second order PDE and classifications to canonical (standard)-parabolic, elliptic, hyperbolic solution by separation of variables,	
10	28	Application of ODE and PDE in Engineering study	CT3
	29	Definition of matrix, different types of matrices, algebra of matrices,	
	30	Transpose and adjoint of a matrix and inverse matrix	
11	31	Solution of system of linear equations	
	32	Solution of system of linear equations	
	33	Solution of system of linear equations	
12	34	Solution of linear equations by using inverse matrix	
	35	Rank, nullity and elementary transformations	
	36	Rank, nullity and elementary transformations	
13	37	Dependent and independent of vectors	
	38	Dependent and independent of vectors	

	39	Matrix polynomials: determination characteristic roots and vectors	
14	40	Characteristic subspace of matrix and eigenvalues and eigenvectors	
	41	Characteristic subspace of matrix and eigenvalues and eigenvectors	
	42	Cayley Hamilton theorem and its application. Finding inverse matrix by using Cayley Hamilton theorem.	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C3
Final Exam	60%	CO1, CO2	C1, C2
Total Marks	100%		

REFERENCE BOOKS

1. Ordinary and Partial Differential Equations- Dr. M.D. Raisinghania,
2. Differential Equations- Shepley L. Ross
3. Elementary Linear Algebra- Howard Anton, Chris Rorres
4. College Linear Algebra- Md. Abdur Rahman

COURSE INFORMATION	
Course Code: LANG 102	Credit Hour: 1.5
Course Title: Communicative English- I	Contact Hour: 3.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
The English language course is designed for the students to develop their competence in communication skills for academic purposes emphasizing speaking, reading, listening and writing. The approach will be communicative and interactive and will involve individual, pair and group work. Students will be exposed to diverse text types to refine their reading skills, engaging in activities and discussions that foster effective writing type. The course incorporates a wide range of reading texts to develop students' critical thinking which is one of the most essential elements required to write a good piece of academic writing. Special emphasis is placed on the various forms of essay including descriptive, narrative, cause-effect, compare-contrast, and argumentative. Upon completion of this course, student should demonstrate proficiency in communication across diverse contexts, engage in group activities, and deliver formal speech for academic, professional and social purposes. This course also incorporates classroom instructions to provide guidelines on presentations and communication skills.Addionally, the couse emphasizes providing constructive feedback on students' oral performances.	
OBJECTIVE	
1. To develop the four basics skills of English language, i.e. listening, speaking, reading and writing. 2. To enhance students' interpersonal skills through participation in various group interactions and activities. 3. To improve students' pronunciation to enhance comprehensibility in both speaking and listening. 4. To gain proficiency in crafting well- organized paragraphs and learn to edit and revise both their own as well as peer's writing.	
COURSE CONTENT	
Speaking: Introduction to Language: Introducing basic skills of language. English for Science and Technology Self-introduction and introducing others: How a speaker should introduce himself to any stranger / unknown person / a crowd. Name, family background, education, experience, any special quality/interest, likings/disliking, etc. Asking and answering questions, **Expressing likings and disliking;** (food, fashion etc.) Asking and giving directions Discussing everyday routines and habits, Making requests/offers/invitations/excuses/apologies/complaints Describing personality, discussing and making plans(for a holiday or an outing to the cinema), Describing pictures / any incident / event Practicing storytelling, Narrating personal experiences/Anecdotes Telephone conversations (role play in group or pair) Situational talks / dialogues: Practicing different professional conversation (role play of doctor-patient conversation, teacher –student conversation) **Listening:** Listening and understanding: Listening, note taking and answering questions; Students will listen to recorded text, note down important information and later on will answer to some questions Difference between different accents: British and American accents; Documentaries from BBC and CNN will be shown and students will try to understand; Listening to short conversations between two persons/more than two. **Reading:** Reading techniques: scanning, skimming, predicting, inference; Reading Techniques: analysis, summarizing and interpretation of texts. **Writing:** Introductory discussion on writing, prewriting, drafting; Topic sentence, paragraph development, paragraph structure, describing a person/scene/picture, narrating an event Paragraph	

writing, Compare-contrast and cause- effect paragraph.													
SKILL MAPPING (CO – PO MAPPING)													
No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: **Communicate** in English quickly and smartly using the techniques learnt in the class.	√											
2	CO2: **Understand** the Techniques of academic reading and writing	√											
3	CO3: **Communicate** ideas and opinions effectively within the shortest possible time										√		
4	CO4: **Excel** in oral and written communication/ Presentation competency										√		

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	**Communicate** in English quickly and smartly using the techniques learnt in the class.	1	C2	-	-	1	Assignment, Quiz
CO2	**Understand** the Techniques of academic reading and writing	1	C3	-	-	1	Project/ Assignment, Quiz
CO3	**Communicate** ideas and opinions effectively within the shortest possible time	10	C4	-	-	1	Project, Assignment, Quiz
CO4	**Excel** in oral and written communication/ Presentation competency	10	C5	-	-	2	Project/ Assignment, Quiz

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom's Taxonomy:

C1 – Remember, C2 – Understand, C3- Apply, C4 – Analyze, C5 - Evaluate, C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R – Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)

Face to Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	20 20
Guided Learning Tutorial/ Assignments	16
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	
Formal Assessment Continuous Assessment (Descriptive writing Reading Test, Listening Test, Public Speaking) Report Submission Presentation	4
Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Introduction to Language: Introducing basic skills of language; English for Science and Technology	Assignment, Project, Quiz
		Self-introduction and introducing others: How a speaker should introduce himself to any stranger / unknown person / a crowd; Name, family background, education, experience, any special quality/interest, likings/disliking, etc.	
		Self-introduction and introducing others: How a speaker should introduce himself to any stranger / unknown person / a crowd; Name, family background, education, experience, any special quality/interest, likings/disliking, etc.	
2	02	Asking and answering questions, Expressing likings and disliking; (food, fashion etc.) Asking and giving directions	
3	03	Discussing everyday routines and habits, making requests/ offers/invitations/ excuses/ apologies/ complaints	
4	04	Describing personality, discussing and making plans (for a holiday or an outing to the cinema), Describing pictures / any incident	

		/ event	
5	05	Practicing storytelling, Narrating personal experiences/Anecdotes	
6	06	Telephone conversations (role play in group or pair); Situational talks / dialogues: Practicing different professional conversation (role play of doctor-patient conversation, teacher –student conversation)	
7	07	Listening and understanding: Listening, note taking and answering questions; Students will listen to recorded text, note down important information and later on will answer to some questions	
8	08	Difference between different accents: British and American accents; Documentaries from BBC and CNN will be shown and students will try to understand	
9	09	Listening to short conversations between two persons/more than two	
10	10	Reading techniques: scanning, skimming, predicting, inference;	
11	11	Reading techniques: scanning, skimming, predicting, inference;	
12	12	Introductory discussion on writing, prewriting, drafting;	
13	13	Topic sentence, paragraph development, paragraph structure, describing a person/scene/picture, narrating an event	
14	14	Paragraph writing, Compare-contrast and cause-effect paragraph	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Compulsory) Descriptive writing Reading Test Listening Test Public Speaking	70%	CO1, CO2, CO3, CO4	C2, C3, C4, C5
Group Presentation	30%	CO1, CO2, CO3, CO4	C2, C3, C4, C5
Total Marks	100%		

REFERENCE BOOKS

1. 1. Langan, J. (2005). College Writing Skills with Readings (6th Ed). McGraw-Hill Publication.

2. Interactions 1 (Reading), John Langan, Latest edition, McGraw-Hill Publication
3. Jones, L. (1981). Functions of English. (Student's Book, 2nd Ed.) Melbourne, Australia: Cambridge University Press.
4. Dixon, R.J. (1987). Complete course in English. (Book 4). New Delhi, India: Prentice Hall of India. (For book presentation).
5. From Paragraph to Essay - Maurice Imhoof and Herman Hudson Headway Series – Advanced Level (2 parts with CDs): Oxford University Press Ltd.
6. Speak like Churchill stand like Lincoln - James C. Humes.
7. Cambridge IELTS Practice Book.
8. Selected Sample Reports and Selected Research Articles.

COURSE INFORMATION	
Course Code: GEBS 101	Credit Hour: 2.0
Course Title: Bangladesh Studies	Contact Hour: 2.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
This course has been designed for undergraduate engineering students to help them learn the rich history of Bangladesh, and to provide them with basic knowledge of historical events which eventually led to the formation of Bangladesh and constitution of Bangladesh, current trends in economic development, legislation, citizen charter, cultural aspects which will make them responsible citizen.	
OBJECTIVE	
1. To equip students with factual knowledge that will enable them to learn the history of Bangladesh. 2. To trace the historical roots of Bangladesh as an independent state focusing on the social, cultural and economic developments that have taken place since its independence. 3. To promote an understanding of the development of Bangladesh and its culture. 4. To create an awareness among the students about the Geography, Economy, Politics and Culture of Bangladesh.	
COURSE CONTENT	
a. Main Contents: Impact of Geography, History, Environment, Economy, Constitution andCulture of Bangladesh in Engineering Application b. Detail Contents: Bangladesh Geography: Location, Area, Boundary, Physiography, River system, Forest andClimate, Demography of Bangladesh, Maritime zones. History: Overview of the ancient Bengal, anthropological identity of the Bengali race, main trends in the history of medieval Bengal, Bengal under the East India Company, religious and social reform movements, nationalist movements, division of the Indian sub-continent, language movement 1948-1952, education movement of 1962, six-point movement of 1966, mass uprising of 1969, war of independence and emergence of Bangladesh in 1971, Constitution of Bangladesh, Pre and post liberation development in the field of engineering and technology, Bangladesh's contribution to world peace and its security, engineering developments in Bangladesh (Kaptai Dam, Padma bridge, power plants, Karnaphuli River Tunnel etc.) and its impact on socio-economic aspect. Environment, Economy and Culture : Land, Characteristics of tropical monsoon climate, Forests and biomass, Fish, Minerals, Health, Education, Agriculture, Industries, NGOs, Population, Sociological and Cultural aspects of	

Bangladesh, Economy and National development, Development and Progress of the Millennium Development Goals (MDGs), Public Administration in Bangladesh, State of Good Governance in Bangladesh, Art and Literature, Main traditional cultural events,
Vision-2021, Digitalization, Tourism and Natural Resources, Bangladesh and International Relations.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to **identify** specific stages of Bangladesh's political history, through the ancient, medieval, colonial and post-colonial periods and variety of cultural identities of Bangladesh.						√						
2	CO2: Be proficient to **explain** the economy and patterns of economic changes through qualitative and quantitative analysis.						√						

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **identify** specific stages of Bangladesh's political history, through the ancient, medieval, colonial and post-colonial periods and variety of cultural identities of Bangladesh.	6	C1, C2	-	-	7	Class Test,Final Exam
CO2	Be proficient to **explain** the economy and patterns of economic changes through qualitative and quantitative analysis.	6	C2 ,C4	-	-	7	Class Test,Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember, C2 – Understand, C3- Apply, C4 – Analyze, C5 - Evaluate, C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R – Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 28 10 --
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture athome • Preparation for final examination	 8 10 18
Formal Assessment a) Pop Quiz/Class Test/Mid-Term Exam b) Final examination	 3 3
Total	80

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introductory class: Brief discussion on the total syllabus, basic requirements of the course, methods of assessment of the course	CT1
	02	Bangladesh Geography: Location, Area, Boundary, Physiography, River System, Forest and Climate, Demography of Bangladesh.	
2	03	Overview of the ancient Bengal, anthropological identity of the Bengali race, main trends in the history of medieval Bengal	
	04	Bengal under the East India Company	
3	05	Religious and Social reform movements	
	06	Nationalist movements, division of the Indian subcontinent	
4	07	Language movement 1948-1952, Education movement of 1962	Mid Term Exam
	08	Language movement 1948-1952, Education movement of 1962	
5	09	Six-point movement of 1966, Mass uprising of 1969	
	10	War of Independence and Emergence of Bangladesh in 1971	
6	11	Constitution of Bangladesh	
	12	Constitution of Bangladesh	
7	13	Bangladesh's contribution to world peace and security, Pre and post liberation development of engineering and technology	
	14	Bangladesh's contribution to world peace and security, Pre and post liberation development of engineering and technology	

8	15	Land, Characteristics of tropical Monsoon climate, Forests and biomass, Fish	
	16	Engineering development in Bangladesh (Kaptai Dam, Padma bridge, power plants, Karnaphuli River Tunnel etc.) and its impact on socio-economic aspect	
9	17	Minerals, Health and Education,	
	18	Agriculture, Industries	
10	19	NGOs, Population, Sociological and Cultural aspects of Bangladesh	CT 2
	20	Economy and national development,	
11	21	Development and Progress of the Millennium Development Goals (MDGs)	
	22	Ultimate Disposal of Solid Waste: Method Public Administration in Bangladesh, State of Good Governance in Bangladesh	
12	23	Art and Literature	
	24	Traditional cultural events	
13	25	Vision-2021, Digitalization	CT 3
	26	Tourism and Natural Resources	
14	27	Bangladesh and International Relations	
	28	Revision of the course	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2	C1, C2, C4
Final Exam	60%	CO1, CO2	C1, C2, C4
Total Marks	100%		

REFERENCE BOOKS

1. Bangladesh Studies: Md. Shamsul Kabir Khan and Daulatunnahar Khanam
2. The Constitution of the People's Republic of Bangladesh
3. Discovery of Bangladesh: Akbar Ali Khan
4. History of Bangladesh, Vols, 1-3: Sirajul Islam
5. History of Modern Bengal, Vol, 1: R C Majumdar
6. Dynastic History of Bengal: Dr. Abdul Mumin Chowdhury
7. A History of Bangladesh: William Van Schendel
8. Geography of Bangladesh: Harun Er Rashid
9. Banglapedia: National Encyclopedia of Bangladesh, Vols, 1-10: Sirajul Islam
10. History of Bengal: (Mughal Period 1526-1765): R. A. Chandra
11. Land of Two Rivers: Nitesh Sengupta
12. A History of Bangladesh: Cambridge University Press
13. Bengali Nationalism and the Emergence of Bangladesh: A.F Salahuddin Ahmed
14. Language Movement and The Making of Bangladesh: Safar Ali Akanda

COURSE INFORMATION	
Course Code: Math 201	Credit Hour: 3.0
Course Title: Vector Analysis, Laplace Transformation and Coordinate Geometry	Contact Hour: 3.0

PRE-REQUISITE

CHEM 103, PHY 129

CURRICULUM STRUCTURE

MATH 101 (Differential and Integral Calculus), MATH 103 (Differential Equations and Matrix)

SYNOPSIS/ RATIONALE

Purpose of this course is to introduce basic knowledge to identify and solve vector mathematical problems, to demonstrate practical applications of Laplace Transform and analyze co-ordinate geometry.

OBJECTIVE

1. Be able to acquire knowledge on vector analysis, Laplace transform and geometry.
2. Be able to solve problems with straight lines, pair of straight lines, circles, conics in 2D and 3D co-ordinate systems.
3. Be able to find the length, volume and area of objects related to engineering study by using vector, Laplace transform, also be able to solve the problems of the pair of straight lines, circles, system of circles, parabola, ellipse.

COURSE CONTENT

Vector Analysis: Definition of vector and scalars & vector algebra, scalar and vector products of two vectors and their geometrical interpretation, triple products and multiple products, differentiation of vectors, gradient of scaler functions, divergence and curl of vector functions, physical significance of gradient, divergence and curl, definition of line, surface and volume integral, integration of vectors, Green's theorem and its application, Stoke's theorem and its application, Gauss theorem and its application in engineering study.

Laplace Transform: Definition of Laplace transform and application of Laplace transform in engineering study, Laplace transform of some standard functions and properties of Laplace transform, sufficient condition for existence of Laplace transform, inverse Laplace transform, some special theorems on Laplace transform, solution of differential equations by Laplace transform, Heaviside expansion formula, convolution theorem, evaluation of improper integral, application of Laplace transform.

Co-ordinate Geometry: Introduction to geometry in engineering study and rectangular co-ordinates, transformation of co-ordinates, changes of axes, pair of straight lines, general equation of second degree and reduction to its standard forms, circles, equation of conics, homogeneous equations of second degree, angle between straight lines, pair of lines joining the origin to the point of intersection of two given curves, equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points), three dimensional co-ordinate system, direction cosines, projections, the plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane), standard equation of sphere, ellipsoid.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Learn the physical explanation of different vector notation and Define Laplace transform, inverse Laplace transform,	√											

	different types of matrices, and their properties.												
2	CO2: Explain the characteristics of conics and familiarize with straight lines, pair of straight lines, circles, radical axis and center in 2D and 3D co-ordinate systems.	√											
3	CO3: Calculate length, volume and area of objects related to engineering study by using vector, Apply Laplace transform to ODE and PDEs and the knowledge of geometry in engineering study. Solve the problems of the pair of straight lines, circles, system of circles, parabola, ellipse etc.	√											

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Define vector terms, Laplace transform and geometrical terms	1	C1	1		3	Class Test, Final Exam, Assignment
CO2	Identify different properties of straight lines, pair of straight lines, circles, radical axis and center in 2D and 3D co-ordinate systems.	1	C2	1		3	Class Test, Mid-term, Final Exam
CO3	Apply Laplace transform and geometry in engineering study.	1	C3	1		3	Assignment, Mid Term, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom’s Taxonomy:						

	C1 – Remember · C2 – Understand · C3- Apply · C4 – Analyze · C5 - Evaluate · C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self- Directed Learning	
• Non-face-to-face learning	25
• Revision of the previous lecture at home	21
• Preparation for the final examination	21
Formal Assessment	
a) Continuous Assessment	8
b) Final Examination	3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Definition of vector and scalar & vector algebra, scalar and vector products of two vectors and their geometrical interpretation	CT1
	02	Definition of vector and scalar & vector algebra, scalar and vector products of two vectors and their geometrical interpretation	
	03	Definition of vector and scalar & vector algebra, scalar and vector products of two vectors and their geometrical interpretation	
2	04	Triple products and multiple products, linear dependence and independence of vectors, Differentiation of vectors	
	05	Gradient of scalar functions, divergence and curl of point functions	
	06	Physical significance of gradient, divergence and curl	
3	07	Definition of line, surface and volume integral, integration of vectors, Green's theorem and application	
	08	Definition of line, surface and volume integral, integration of vectors, Green's theorem and application	
	09	Green’s theorem and its application	
4	10	Gauss theorem and its application in Engineering	CT2
	11	Stoke's theorem and its application.	
	12	Introduction to geometry for engineering and rectangular co-ordinates, transformation of co-ordinates	

5	13	Changes of axes, pair of straight lines, general equation of second degree and reduction to its standard forms and properties	
	14	Changes of axes, pair of straight lines, general equation of second degree and reduction to its standard forms and properties	CT 3
	15	Changes of axes, pair of straight lines, general equation of second degree and reduction to its standard forms and properties	
6	16	Circles (tangents, normal, chord of contact, pole and polar), equation of conics, homogeneous equations of second degree, angle between straight lines, pair of lines joining the origin to the point of intersection of two given curves	
	17	Circles (tangents, normal, chord of contact, pole and polar), equation of conics, homogeneous equations of second degree, angle between straight lines, pair of lines joining the origin to the point of intersection of two given curves	
	18	Circles (tangents, normal, chord of contact, pole and polar), equation of conics, homogeneous equations of second degree, angle between straight lines, pair of lines joining the origin to the point of intersection of two given curves	
7	19	Circles (tangents, normal, chord of contact, pole and polar), equation of conics, homogeneous equations of second degree, angle between straight lines, pair of lines joining the origin to the point of intersection of two given curves	Mid Term Exam
	20	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points)	
	21	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points)	
8	22	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points)	
	23	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points)	
	24	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points)	
9	25	Three dimensional co-ordinate system, direction cosines, projections, plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane), straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid	

	26	Three dimensional co-ordinate system, direction cosines, projections, plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane), straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid	
	27	Three dimensional co-ordinate system, direction cosines, projections, plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane), straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid	
10	28	Three dimensional co-ordinate system, direction cosines, projections, plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane), straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid	CT 4
	29	Definition of Laplace transform and Application of Laplace transform for Engineering, Laplace transform of some elementary functions and properties of Laplace transform	
	30	Definition of Laplace transform and Application of Laplace transform for Engineering, Laplace transform of some elementary functions and properties of Laplace transform	
11	31	Sufficient condition for existence of Laplace transform	
	32	Laplace transform of derivatives and its application	
	33	Laplace transform of Integration with application, Laplace transform of sine and cosine integral	
12	34	Unit step function and its application	
	35	Periodic function with examples, Laplace transform of some special function.	
	36	Definition of inverse Laplace Transform and its properties	
13	37	Partial fraction and its application in inverse Laplace Transform	
	38	Heaviside formula and its application	
	39	Convolution theorem, Evaluation of improper integral, Application of Laplace transform	
14	40	Solve ordinary differential equation s by Laplace transform	
	41	Solve partial differential equation s by Laplace transform	
	42	Application of Laplace transform in Engineering study	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C3
Final Exam	60%	CO1, CO2, CO3	C1, C2, C3
Total Marks	100%		

TEXT BOOKS

1. Vector Analysis- Murray R. Spiegel, Seymour Lipschutz, Dennis Spellman
2. Laplace Transforms- Murray R. Spiegel
3. A Text Book on Co-ordinate Geometry with Vector Analysis - Rahman & Bhattacharjee.

REFERENCE BOOKS

1. Vector Analysis- K.A. Strout, Dexter Booth
2. A Student's Guide to Laplace's Transforms by Deniel Fleisch

COURSE INFORMATION	
Course Code: MATH 203	Credit Hour: 3.0
Course Title: Applied Math for Engineering	Contact Hour: 3.0

PRE-REQUISITE

MATH-101 (Differential and Integral Calculus), MATH-103 (Differential Equations and Matrix), MATH-201 (Vector Analysis, Laplace Transformation and Coordinate Geometry)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will be introduced to various methods to solve various civil, environmental and water resources engineering problems dealing with Fourier Analysis. Students will also be able to apply different methods to solve above mentioned problems with by statistical tools.

OBJECTIVE

1. To formulate civil, environmental and water resources engineering problems into mathematical frameworks and solve the resulting models by using Fourier analysis.
2. To understand the basic concepts of probability distributions, Bayesian inference and relevant statistical methods. These concepts comprise foundational material utilized heavily in later year courses, particularly in water, structural and geotechnical engineering.

COURSE CONTENT

Fourier Analysis: Definition and expansion of a function of x, real and complex form of Fourier series, physical applications of Fourier series, finite transform, Fourier integral, Fourier transforms, inverse Fourier transforms and their uses in solving boundary value problems (Wave equations, heat equations and damped equations).

Statistics: Frequency distribution, measures of central tendency and dispersion, variation, skewness and kurtosis, concept of probability, conditional probability, probability distributions i.e. binomial, Poisson, negative exponential, normal, sampling of mean and standard deviation by normal, Chi-square distributions, sampling theory, hypothesis testing, inference including t-tests, correlation and regression analysis.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Identify periodic functions with various periods. Apply Fourier analysis to solve civil, Environmental and water resources engineering problems.	√	√										
2	CO2: Recognize different types of functions in Fourier series, analyze them and execute boundary value problems.	√	√										
3	CO3: Describe data in easy way in which information can easily be expressed in numerical form. Select and compare data on specific field and analysis to take the best decision among	√	√	√									

	alternatives. Identify and interpret sampling theory and different test for future situations.												

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to define periodic function, Fourier transform.	1	C1	1,3	-	2,6	Class Test/Class Assignment/Final exam
CO2	Be able to apply probability distribution theory and Bayesian inference to civil, environmental and water resources engineering problems focusing probability and statistical analysis	2	C3	1,3	-	2,4	Class Test/Class Assignment/Final exam
CO3	Be able to develop simple probabilistic models to evaluate uncertainty in probability and statistical analysis into engineering systems	1	C4	1, 2,3	-	2,4,6	Class Test/Class Assignment/Final exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember; C2 – Understand; C3- Apply; C4 – Analyze; C5 - Evaluate; C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Guided Learning Tutorial/ Assignments (2 hours/week × 6 weeks)	12

Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for quiz and final exam	48 7
Formal Assessment c) Continuous Assessment d) Final Examination	08 03
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Learning (PBL)

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01 02 03	Definition and expansion of a function of x, real and complex form of Fourier series.	Final Exam
2	04 05 06	Physical applications of Fourier series	Class Test/Class Assignment/ Final Exam
3	07 08 09	Fourier integral	Mid Term/ Class Assignment/ Final Exam
4	10 11 12	Finite and infinite Fourier transforms	
5	13 14 15	Inverse Fourier transforms	
6	16 17 18	Solution of boundary value problems (Wave equations, heat equations)	Class Test/Final Exam
7	19 20 21	Solution of boundary value problems (damped equations)	
8	22 23 24	Frequency distribution, measures of central tendency and dispersion	Mid Term/ Class Assignment/ Final Exam
9	25 26 27	Variation, skewness and kurtosis, concept of probability, conditional probability	
10	28 29 30	Probability distributions: Binomial, Poisson, negative exponential, normal	
11	31 32 33	Sampling of mean and standard deviation by normal, Chi-square distributions	
12	34 35 36	Sampling theory, Hypothesis testing	Class Test/ Final Exam
13	37 38 39	Inference including t-tests	
14	40		

	41 42	Correlation and regression analysis	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1,C3, C4
Final Exam	60%	CO1, CO2, CO3	C1,C3, C4
Total Marks	100%		

TEXT BOOKS

1. Fourier Analysis with Applications to Boundary Value Problems- Murray R. Spiegel
2. Probability and Statistics for Engineers, Richard L. Scheaffer, James T. McClave

REFERENCE BOOKS

1. Advanced Engineering Mathematics -Michael D. Greenberg
2. Introduction to Probability and Statistics for Engineers and Scientists- Sheldon M. Ross

COURSE INFORMATION	
Course Code: GEA 201	Credit Hour: 2.0
Course Title: Principles of Accounting	Contact Hour: 2.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
-	

OBJECTIVE

1. Introduce fundamental principles and concepts of accounting, including the accounting equation and the double-entry bookkeeping system.
2. Explain the preparation and interpretation of financial statements, such as Statement of Financial Position, Statement of Comprehensive Income, Statement of Changes in Equity.
3. Develop a comprehensive understanding of cost accounting principles and concepts, including cost classification and cost behavior.
4. Develop the competency to apply cost accounting tools to make informed business decisions, including Absorption costing and Variable costing, CVP Analysis, Job Order Costing and Process costing and Relevant Costing.

COURSE CONTENT

a. **Main Contents:**

(1) Accounting in Action
(2) Recording Process
(3) Adjusting the Accounts and prepare financial statement
(4) Financial Statement Analysis
(5) Computerized Accounting System and
(6) Cost Concepts
(7) Absorption costing and Variable costing
(8) Job Order Costing and Process Costing
(9) Short & Long-Term Decision-Making in Accounting

b. **Detail Contents:**

(1) Accounting in Action
  a. History & Definition of Accounting,
  b. Objectives and Importance of Accounting
  c. Accounting & Engineering
  d. International Financial Reporting Standard (IFRS), Generally Accepted Accounting Principles (GAAP), Ethics in Accounting
  e. Accounting Equation (Math)

(2) Recording Process: Journal, Ledger, T-account and Trial balance
(3) Adjusting the Accounts: Adjusting Entries , Adjusted Trial Balance, Income Statement, Retained Earnings Statement and Statement of Financial Position (Balance Sheet)
, Worksheet
(4) Financial Statement Analysis: Horizontal Analysis, Vertical Analysis and Ratio Analysis

(5) Computerized Accounting System: Manual vs. Computerized Accounting system, Some Accounting Software: QuickBooks, Xero, Zoho Books, Sage 50, TallyPrime.

(6) Cost Concepts:

a. Explain the Distinguishing Features of Managerial Accounting
b. Identify the Three Broad Functions of Management
c. Classification of Costs on Various Bases
d. Indicate How Cost of Goods Manufactured is Determined, Break Even Point (BEP)for Different Projects.

(7) Absorption costing and Variable costing:

a. Prepare Profit Statements Based on a Variable Costing and Absorption Costing system.
b. Cost Volume Profit (CVP) Analysis for different engineering projects
c. Account for the difference in profits between variable and absorption costing profitcalculations
d. Explain the arguments for and against variable and absorption costing

(8) Job Order Costing and Process Costing:

a. Job Order Costing
b. Process Costing

(9) Short & Long-Term Decision-Making in Accounting:

a. Relevant & Irrelevant Costs for Decision-Making
b. How to Determine Costs & Make Decisions
c. Contrast annual rate of return and cash Payback in Capital Budgeting, Budgeting for various Engineering Projects.
d. Distinguish between the Net Present Value and Internal Rate Of Return Methods

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Understand the fundamental principles of financial and cost accounting											√	
2	CO2: Understand financial reporting and analysis											√	
3	CO3: Understand cost behavior and cost control											√	
4	CO4: Apply cost accounting tools for making informed business decisions											√	

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Understand the fundamental principles of financial and cost accounting	11	C2	-	-	1	Assignment,Final Exam

CO2	Understand financial reporting and analysis	11	C2	-	-	1	Mid- Term,Final Exam
CO3	Understand cost behavior and cost control	11	C2	-	-	1	Mid- Term,Final Exam
CO4	Apply cost accounting tools for making informed business decisions	11	C2	-	-	1,2	Assignment,Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face to Face Learning Lecture (2 hours/week x 14 weeks)	28
Guided Learning Tutorial/ Assignments (2 hours/week x 5 weeks)	10
Independent Learning Individual learning (1-hour lecture ≈ 1 hour learning) Preparation for tests and examination	24 13
Formal Assessment a) Pop Quiz/Class Test/Mid-Term Exam b) Final examination	2 3
Total	80
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Meaning, history and definition of accounting	CT1
	02	The users and uses of accounting.	
2	03	Ethics in financial reporting	
	04	The cost principle, monetary unit assumption, and the economic entity assumption	
3	05	Accounting equation and its components	
	06	The effects of business transactions on accounting	
4	07	Four financial statements and how they are prepared.	
	08	Journal	

5	09	Journal	
	10	T-account, Ledger, Trial balance	
6	11	Adjusting Accounts	
	12	Worksheet.	
7	13	Completion of the Accounting cycle.	Mid Term Exam
	14	Financial Statement Analysis	
8	15	Managerial Accounting Basics	
	16	Cost Concepts	
9	17	Job Order Cost Accounting	CT2
	18	Job Order Cost Accounting	
10	19	Process Cost Accounting	
	20	Process Cost Accounting	
11	21	Cost-Volume-Profit Relationships	
	22	Cost-Volume-Profit Relationships	CT3
12	23	Performance Evaluation through Standard Costs	
	24	Performance Evaluation through Standard Costs	
13	25	Incremental Analysis	
	26	Incremental Analysis	
14	27	Capital Budgeting	
	28	Capital Budgeting	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2
Final Exam	60%	CO1, CO2, CO3, CO4	C2
Total Marks	100%		

REFERENCE BOOKS

4. Financial Accounting IFRS edition by Weygand, Kimmel & Kieso (3th)
5. Accounting Principles by Weygandt, Kieso& Kimmel (IFRS Latest edition)

COURSE INFORMATION	
Course Code: GEE 201	Credit Hour: 2.0
Course Title: Fundamentals of Economics	Contact Hour: 2.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
-	
OBJECTIVE	
1. To help students demonstrate the knowledge of the fundamental concepts of economics. 2. To teach how efficiency in organizational decision-making can be achieved. 3. To help students understand consumer behavior, elasticity of market demand and different market structure. 4. To help students realize the importance of various macroeconomic aggregates such as national income, full employment, unemployment, consumption and savings function, inflation, productivity and the major challenges associated with the measurement of these aggregates. 5. To help students apply the basic theories of economics to make their project management cost-effective. 6. To help students recognize the basic features of economic development and regarding planning for the economy of the country.	
COURSE CONTENT	
Fundamental of Economics: Definition Production Possibility Frontier and Engineering Decision: 1. PPF Curve.; Applying the PPF to Society ‘s Choices by the Engineers. Utility Theory: Law of diminishing marginal utility. Demand: 1. Definition. 2. Law of Demand. 3. Market Demand. 4. Reason for demand curve downward slopping. Mathematical Analysis Supply: 1. Definition. 2. Supply curve. 3. Market Equilibrium. Elasticity of Demand: 1. Different types of elasticity. 2.Different types of price elasticity. 3.Relation between AR, MR and elasticity. 4. Mathematical Analysis Indifference Curve Analysis Consumers Equilibrium: Budget Line, MRS, Consumer Choice Production Function from Engineering point of view: 1. TP, AP, MP. 2. Law of Variable proportion. 3. Law of returns Cost Analysis and Engineering Economics: 1. TC, AC, MC. 2. Short run cost analysis Analysis of Market Structure and Engineering Decision: 1. Perfectly Competitive Market; 2. Monopoly and Monopolistic Market Key concept of Macroeconomics: Definition National Income: GDP, GNP, NNP, NI Circular Flow of National Income and Engineering Resources: Two, Three and Four sector Economy Savings: Savings Function, APS, MPS. Derive the savings function from consumption functions, mathematically and graphically. Consumptions: Consumption functions, APC, MPC Investment: Investment Theories, Investment Multiplier Engineering Plan considering the Inflation Rate of the Country: Demand-Pull and Cost-Push Inflation The Effect of Monetary policy on Engineering Plan: Impact and Use The Effect of Fiscal Policy on Engineering Plan: Impact and Use Theories of Developments: 1 or 2 Theories of Economic Development. Environmental problems; Conversion and load management; The long run issues: Exchange between long run & short run benefits of projects.	

Renewable energy and non-renewable energy: The allocation over N periods; Efficient inter-temporal allocations

Environmental Sustainability: SDG goals and progress of Bangladesh.
Economic Problems in Developing Countries especially in Bangladesh.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to understand the basic concepts and principles of Microeconomics; demand, supply¸ market equilibrium, consumer behavior, production, market structure and Macroeconomics; national income, employment, consumption function, saving function, inflation.	√											
2	CO2: Be able to determine the equilibrium of in micro & macroeconomic level to reach maximum social welfare. Understand financial reporting and analysis											√	
3	CO3: Be able to analyze consumer behavior, production process, cost of production and market structure to the benefit of both the consumer and the producer.											√	
4	CO4: Be able to evaluate the economy of Bangladesh through national income, consumption, investment, inflation situation and recommend economic policy to develop the domestic economy as well as the relationship with the global economy.											√	

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to understand the basic concepts and principles of Microeconomics; demand, supply¸ market equilibrium, consumer behavior, production, market	1	C2	-	-	1	Class Test, Mid Term, Final Exam

	structure and Macroeconomics; national income, employment, consumption function, saving function, inflation.						
CO2	Be able to determine the equilibrium of in micro & macroeconomic level to reach maximum social welfare.	11	C3	-	-	1	Class Test, Mid Term, Final Exam
CO3	Be able to analyze consumer behavior, production process, cost of production and market structure to the benefit of both the consumer and the producer.	11	C4	-	-	1,2	Class Test, Mid Term, Final Exam
CO4	Be able to evaluate the economy of Bangladesh through national income, consumption, investment, inflation situation and recommend economic policy to develop the domestic economy as well as the relationship with the global economy.	11	C4	-	-	1,2	Class Test, Mid Term, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face to Face Learning Lecture (2 hours/week x 14 weeks)	28
Guided Learning Tutorial/ Assignments (2 hours/week x 5 weeks)	10
Independent Learning Individual learning (1-hour lecture ≈ 1 hour learning) Preparation for tests and examination	24 13
Formal Assessment c) Pop Quiz/Class Test/Mid-Term Exam d) Final examination	2 3
Total	80

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Introduction to Engineering Economics Importance of Economics in Engineering.	CT1

	02	Definition of economics, Difference between micro and macroeconomics. Production possibility frontier (PPF) and Engineering choice.	
2	03	Demand and determinants of Demand	
	04	Demand curve related basic idea and Mathematical Application	
3	05	Supply and Determinants. Market Mechanism.	
	06	Consumer Choice (Indifference Curve and Budget Line)	
4	07	Indifference Curve, Properties of IC, MRS	
	08	Theory of production in the point of view of Engineers	
5	09	Theory of cost, Short run and long run cost curve	
	10	Firms Equilibrium (Concepts)	
6	11	Different types of Market.	
	12	How the Engineers will act in perfectly competitive market.	
7	13	How the Engineers will act in Monopoly Market	Mid Term Exam
	14	National Income analysis	
8	15	Aggregate demand and Aggregate Supply	
	16	Determination of Level of Income and Employment	
9	17	Keynes Full Employment Theory	CT2
	18	Circular flow of Income and Expenditure (How engineers will utilize the resources and decision-making process of project plan)	
10	19	Consumption Function	
	20	Saving Function	
11	21	Inflation, Type of Inflation	
	22	Impact of Inflation	CT3
12	23	Unemployment problem and its impact on society	
	24	Cost benefit analysis	
13	25	Theories of Economic Development	
	26	Economic Problems in Developing Countries	
14	27	Contribution of the Engineers in the Economic Development of Bangladesh.	
	28	How the Engineers compare their development projects in the context of World Economy.	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C3, C4
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Economics by P. A. Samuelson and W. D. Nordhaus (7th Edition)
2. Microeconomics by Robert S. Pindyck and Daniel L. Rubinfeld (8th Edition)
3. Macroeconomics by N. Gregory Mankiw (8th Edition)
4. Principle of Economics by N. Gregory Mankiw (8th Edition)

5. Engineering Economics by Niall M. Fraser and Elizabeth M. Jewkes. (5th Edition)

COURSE INFORMATION	
Course Code: GES 201	Credit Hour: 2.0
Course Title: Fundamentals of Sociology	Contact Hour: 2.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
OBJECTIVE	
4. Understanding social phenomena	
COURSE CONTENT	
a. Main Contents: Understanding society, social phenomena and social change b. Detail Contents: Nature and scope Sociological imagination, Perspectives of sociology, Stages of social research and research method, Culture and civilization, Socialization and self - development, Globalization and social changes, Media and individual, Social organizations and social problems, 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 changes and technology.	
SKILL MAPPING (CO – PO MAPPING)	

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to understand the basic nature, scope and perspectives of sociology	√	√										
2	CO2: Be proficient to apply sociological imagination to the context of social problems of BD society			√									
3	CO3: Be able to understand the stages of social research processes and methodologies							√					
4	CO4: Be skilled enough to analyze different cultures, civilizations and different social problems and design solutions for those											√	

5	CO5: Be able to understand and analyze social stratification, different social systems, socialism, capitalism and relate them to BD society							√					
6	CO6: Be able to apply contextual knowledge to assess societal and cultural issues in environmental Context for sustainable development							√					

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to understand the basic nature, scope and perspectives of sociology	1,2	C1, C2	1		7	Assignment, Class Test, Final Exam
CO2	Be proficient to apply sociological imagination to the context of social problems of BD society	3	C3	1		7	
CO3	Be able to understand the stages of social research processes and methodologies	7	C2	1		7	Mid Term Exam, Final Exam
CO4	Be skilled enough to analyze different cultures, civilizations and different	11	C4	1,3		7	Mid Term Exam, Final Exam

	social problems and design solutions for those						
CO5	Be able to understand and analyze social stratification, different social systems, socialism, capitalism and relate them to BD society	7	C2	1		7	Assignment, Class Test, Final Exam
CO6	Be able to apply contextual knowledge to assess societal and cultural issues in environmental context for sustainable development	7	C3	1		7	Class Test, Final Exam

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	28 10 --
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture athome • Preparation for final examination	8 10 18
Formal Assessment a) Pop Quiz/Class Test/Mid-Term Exam b) Final examination	3 3
Total	80

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Definition, nature and scope of sociology	CT1
	02	Sociological imagination	
2	03	Perspectives of sociology	
	04	Orientation of sociological theories (Classical, Contemporary and Post-modern)	
3	05	Social research and its process.	
	06	Research designs and techniques	
4	07	Introducing culture and its variations	
	08	Civilization and theories of civilization.	
5	09	Defining family and its changes	
	10	Socialization process and development of self	
6	11	Introducing globalization and its impact on human life	Mid Term Exam
	12	Factors responsible to globalization	
7	13	Media and its impact in modern society	
	14	Addressing social problems of Bangladesh	
8	15	Introducing social groups and organizations	
	16	Introducing bureaucracy and good governance	
9	17	Introducing social stratifications and social inequality	CT2
	18	Poverty and its types and dimensions	
10	19	Industrial revolution and aftermath	
	20	Urbanization and city development	
11	21	Capitalism: features and influence in the contemporary society	
	22	Socialism: features and influence in the contemporary society	
12	23	Environment and human activities	
	24	Climate change and global risk	
13	25	Population of Bangladesh: problem or prospect	
	26	Crime and deviance: a brief analysis	
14	27	Review 1	
	28	Review 2	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4, CO5	C1, C2, C3, C4
Final Exam	60%	CO1, CO2, CO3, CO4, CO5, CO6	C1, C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Sociology in Modules: by – Richard Schaefer, 2nd edition, 2013

2. Sociology - Primary Principles: by CN Shankar Rao 3. Anthony Giddens- 5th edition 4. Relevant journal

COURSE INFORMATION	
Course Code: LANG 202	Credit Hour: 1.5
Course Title: Communicative English- I I	Contact Hour: 3.0
PRE-REQUISITE	
LANG 102	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
The English language course is designed for the students to develop their competence in communication skills for academic purposes emphasizing speaking, reading, listening and writing. The approach will be communicative and interactive and will involve individual, pair and group work. Students will be exposed to diverse text types to refine their reading skills, engaging in activities and discussions that foster effective writing type. The course incorporates a wide range of reading texts to develop students' critical thinking which is one of the most essential elements required to write a good piece of academic writing. Special emphasis is placed on the various forms of essay including descriptive, narrative, cause-effect, compare-contrast, and argumentative. Upon completion of this course, student should demonstrate proficiency in communication across diverse contexts, engage in group activities, and deliver formal speech for academic, professional and social purposes. This course also incorporates classroom instructions to provide guidelines on presentations and communication skills. Additionally, the course emphasizes providing constructive feedback on students' oral performances.	
OBJECTIVE	
1. To develop English language skills to communicate effectively and professionally. 2. To strengthen students' presentation skills. 3. To develop competency in academic reading and writing.	
COURSE CONTENT	
Reading: Reading Comprehension: Practice using different techniques Academic reading: comprehension from departmental or subject related passages; Vocabulary for Engineers (some common Engineering terms for both general and dept specific); Reading subject specific text to develop vocabulary **Writing:** Writing semi-formal, Formal/official letters, Official E-mail Applying for a job: Writing Cover Letter and Curriculum Vitae; Essay writing: writing steps, principles and techniques, outlining, revising, editing, proofreading; Narrative and descriptive writing: comparison-contrast and cause-effect, argumentative and opinion expression, assignment writing; Analyzing and describing graphs or charts; Practicing analytical and argumentative writing **Speaking:** Public Speaking: Basic elements and qualities of a good public speaker; Set Speech and Extempore Speech: How to get ready for any speech – set or extempore. Individual / Group presentation: How to be ready for presentation, prepare the script for a good speech, prepare power point slides, etc. Selected books/Selected stories for presentation. **Listening:** Listening to long lectures on some topics, Listening and understanding speeches/lectures of different accents.	
SKILL MAPPING (CO – PO MAPPING)	

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: **Understand** the techniques of academic reading and become familiar with technical vocabularies.	√											
2	CO2: **Understand** the techniques of effective academic writing including research article/report writing.	√											
3	CO3: **Communicate** effectively to present their reports and research work within the shortest possible time										√		
4	CO4: **Analyze** any problem critically, interpret data and synthesize information to provide valid conclusions.										√		

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	**Understand** the techniques of academic reading and become familiar with technical vocabularies	1	C2	-	-	1	Assignment, Quiz
CO2	**Understand** the techniques of effective academic writing including research article/report writing.	1	C3	-	-	1	Project/ Assignment, Quiz
CO3	**Communicate** effectively to present their reports and research	10	C4	-	-	1	Project, Assignment, Quiz

	work within the shortest possible time						
CO4	**Analyze** any problem critically, interpret data and synthesize information to provide valid conclusions.	10	C5	-	-	-	Project/ Assignment, Quiz
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember, C2 – Understand, C3- Apply, C4 – Analyze, C5 - Evaluate, C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face to Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 20 20
Guided Learning Tutorial/ Assignments	 16
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	
Formal Assessment Continuous Assessment (Descriptive writing Reading Test, Listening Test, Public Speaking) Report Submission Presentation	4
Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method
COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Reading Comprehension: Practice using different techniques	Assignment, Project, Quiz
2	02	Academic reading: comprehension from departmental or subject related passages	
3	03	Vocabulary for Engineers (some common Engineering terms for both general and dept specific) Reading subject specific text to develop vocabulary	
4	04	Writing semi-formal, Formal/official letters, Official E-mail	
5	05	Applying for a job: Writing Cover Letter and Curriculum Vitae Practicing storytelling, Narrating personal experiences/Anecdotes	
6	06	Essay writing: writing steps, principles and techniques, outlining, revising, editing, proofreading;	
7	07	Narrative and descriptive writing: comparison-contrast and cause – effect, argumentative and opinion expression, assignment writing;	
8	08	Analyzing and describing graphs or charts	
9	09	Practicing analytical and argumentative writing	
10	10	Public Speaking: Basic elements and qualities of a good public speaker	
11	11	Set Speech and Extempore Speech: How to get ready for any speech – set or extempore.	
12	12	Individual / Group presentation: How to be ready for presentation, prepare script for good speech, preparing power point slides, etc. Selected books/Selected stories for presentation.	
13	13	Listening to long lecture on some topics	
14	14	Listening and understanding speeches/lectures of different accents	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Compulsory) Descriptive writing Reading Test	70%	CO1, CO2, CO3, CO4	C2, C3, C4, C5

Listening Test Public Speaking			
Group Presentation	30%	CO1, CO2, CO3, CO4	C2, C3, C4, C5
Total Marks	100%		

REFERENCE BOOKS

1. Jones, L. (1981). Functions of English. (Student's Book, 2nd Ed.) Melbourne, Australia: Cambridge University Press.
2. Dixon, R.J. (1987). Complete course in English. (Book 4). New Delhi, India: Prentice Hall of India. (For book presentation).
3. Langan, J. (2005). College Writing Skills with Readings (6th Ed). McGraw-Hill Publication.
4. Interactions 1 (Reading), John Langan, Latest edition, McGraw-Hill Publication

5.3. Courses Offered by Academic Wing

COURSE INFORMATION	
Course Code: GERM 352	Credit Hour: 1.0
Course Title: Fundamentals of Research Methodology	Contact Hour: 2.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
The Fundamentals of Research Methodology is a hands-on course designed to impart education in the foundational methods and techniques of academic research in Science and Engineering context. UG students would examine and be practically exposed to the main components of a research framework i.e., problem definition, research design, data collection, ethical issues in research, time management, report writing, and presentation. Once equipped with this knowledge, participants would be well-placed to conduct disciplined research under supervision in an area of their choosing. In addition to their application in an academic setting, many of the methodologies discussed in this course would be similar to those deployed in professional research environments.	
OBJECTIVE	
The primary objective of this course is to provide orientation to the UG students on how to conduct a research project. Some other objectives of the course are: 1. To evaluate/review related extant literature, form a variety of sources, pertinent to the research objectives/questions. 2. To expose students to various research methodologies (design), relevant to the research problem needing to be addressed. 3. To explain and justify how researchers will collect and analyze research data. 4. To educate students in the common mistakes, research misconduct, professionalism and ethical considerations while conducting research in respective field.	
COURSE CONTENT	
Foundations of Research: Meaning of Research, Definitions of Research, Objectives of Research, Motivation in Research, General Characteristics of Research, Criteria of Good Research, Types of Research, and Concept of theory, empiricism, deductive and inductive theory, Characteristics of scientific method. **Problem Identification and Formulation:** Meaning and need of Review of Literature, How to Conduct the Review of literature, Research Question – Investigation Question –Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance. **Research Design:** Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental/Computational Design: Concept of Independent & Dependent variables. **Data Analysis:** Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association. **Research Misconduct and Ethics:** Understand the research misconduct, type of research misconduct, Ethical issues in conducting research, Ethical issues related to publishing, Plagiarism and Self-Plagiarism. **Use of Tools / Techniques for Research:** Layout of a Research Paper, Methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for	

paper formatting like LaTeX/MS Office, Software for detection of Plagiarism. Time management and developing Gantt Charts.													
SKILL MAPPING (CO – PO MAPPING)													
No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to understand the research fundamentals, ethics as a researcher, professional conduct in a research team and formulate problem statement and research objectives.						√			√			
2	CO2: Be able to formulate and compose a research proposal considering research activities/design, background studies, and following standard guidelines.				√								√
3	CO3: Be able to improve academic writing and presentation skills and demonstrate ethical considerations in conducting research.								√		√		

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to understand the research fundamentals, ethics in conducting research, professional conduct in research teamwork and formulate problem statement and research questions or objectives.	6,9	C2	1,3	–	8	Class Quiz, Midterm and Final Quiz, Presentation
CO2	Be able to formulate and compose a research proposal considering research activities/design, background studies, and following standard guidelines.	4,12	C6	1,7	–	6,8	Report Submission

CO3	Be able to improve academic writing and presentation skill and demonstrate ethical considerations in conducting research.	8,10	C2	1,2	–	7	Project Proposal Prestation and Report Submission
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning ▪ Lecture ▪ Practical/ Tutorial/ Studio	 24 12
Self- Directed Learning ▪ Prepare project presentation ▪ Conduct literature review for project report	 5 15
Formal Assessment • Class Quiz • Project Proposal Report • Presentation • Final Quiz	 1 20 2 1
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	**Topics to be Covered**	**Assessment**
1	Foundations of Research: Meaning of Research, Definitions of Research, Objectives of Research, Motivation in Research, General Characteristics of Research, Criteria of Good Research, Types of Research, Concept of theory, empiricism, deductive and inductive theory, Characteristics of scientific Method.	
2	Practice session on Foundations of Research	Class Quiz

3	Problem Identification & Formulation: Meaning & need of Review of Literature, How to Conduct the Review of literature, Research Question – Investigation Question – Measurement Issues –Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance.	
4	Practice session on Problem Identification & Formulation	Preliminary Presentation on project proposal
5	Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables	
6	Practice session on Research Design	Class Quiz
7	Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.	Midterm Quiz
8	Practice session on Data Analysis	
9	Research Misconduct and Ethics: Understand the research misconduct, type of research misconduct, Ethical issues in conducting research, Ethical issues related to publishing, Plagiarism and Self- Plagiarism.	
10	Practice session on Research misconduct and Ethics	
11	Use of Tools / Techniques for Research: Layout of a Research Paper, Methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism. Time management and developing Gantt Charts.	Final Quiz
12	Practice session on Use of tools / techniques for Research	
13	Review Session (Theory) – I /Final Presentation	Final Presentation
14	Review Session (Practice) – II /Final Report Submission	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Assessment (Class assignments/ Presentation/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C6
Project Proposal Report	30%	CO1, CO2, CO3	C2, C6
Final Quiz	30%	CO1, CO2, CO3	C2, C6
Total Marks	100%		

REFERENCE BOOKS

1. Engineering Research Methodology: A Practical Insight for Researchers. Springer, by Deb, Dipankar, Dey, Rajeeb, Balas, Valentina E.
2. Research Methods for Engineers, 1st Edition, by David V. Thiel.
3. Handbook of Research Methodology by Talati, J.K.

4. Introducing Research Methodology: A Beginner′s Guide to Doing a Research Project by Uwe Flick
5. DRM, a Design Research Methodology by Lucienne T.M. Blessing and Amaresh Chakrabarti
6. Research Methods: Information, Systems, and Contexts by Kirsty Williamson, Graeme Johanson
7. Zelkowitz, M. V. and Wallace, D. R. (1998), Experimental models for validating technology, Computer, vol. 31, no. 5, pp. 23-31.
8. Internet, mail, and mixed-mode surveys: the tailored design method (3rd ed.) by Dillman, D. A., Smyth, J. D., & Christian, L. M.
9. Improving survey questions: design and evaluation. Sage Publications, by Fowler, F. J.
10. Applied multiple regression/correlation analysis for the behavioral sciences (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates, by Cohen, J., Cohen, P., West, S., & Aiken, L.
11. Experimental and Quasi-Experimental Design for Generalized Causal Inference. Boston, Mass: Houghton Mifflin, by Shadish W.R., Cook T.D. & Campbell P.T.
12. Computational handbook of statistics (4th ed.). New York: Longman, by Bruning, J. L. & Kintz, B. L.

5.4. Courses Offered by Department of Civil Engineering (CE)

COURSE INFORMATION	
Course Code: CE 385	Credit Hour: 3.0
Course Title: Design of Civil Engineering Structures I	Contact Hour: 3.0
PRE-REQUISITE	
EWCE 101 (Analytica; Mechanics), EWCE 211 (Mechanics of Solids)	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
It is the design course for reinforced concrete structures, specially designing of various components, such as beam and slab, of a reinforced concrete building. In this course students will learn how to design a reinforced concrete beam and slab due to flexural and shear force. Knowledge gained from this course will be used in later semesters and in professional life.	
OBJECTIVE	
1. To obtain fundamental knowledge of reinforced concrete material. 2. To gain experience in the design of reinforced concrete beam and slab for flexure, web reinforcement requirement for beam and bond and anchorage for various members of a building. code provisioned 3. To be familiar with the code provisioned safety and serviceability of reinforced concrete structures.	
COURSE CONTENT	
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.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Able to **understand** the Fundamental mechanics and design methodology of reinforced cement concrete (RCC) according to updated code.	√	√										
2	CO2: Able to **design** different types of beams (singly reinforced, doubly reinforced and T-beam), slabs (one-way and two-way) and web reinforcement for beam	√	√	√									
3	CO3: Able to **generate** practical detail drawings of RCC beams and slab accounting the code provisioned development length, anchorage, and splicing requirement of reinforcing bars	√	√	√									

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to **understand** the fundamental mechanics and design methodology of reinforced cement concrete (RCC) according to updated code.	1	C2	1		3,4	Class Test, Final Exam
CO2	Able to **design** different types of beams (singly reinforced, doubly reinforced and T-beam), slabs (one-way and two-way) and web reinforcement for beam	3	C4, C5	1		4,5,6	Class Test, Mid-term, Final Exam
CO3	Able to **generate** practical detail drawings of RCC beams and slab accounting the code provisioned development length, anchorage, and splicing requirement of reinforcing bars	3	C4	1		4,5	Assignment, Class Test, Final Exam

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom’s Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture (3 hours/week × 14 weeks)	42
Guided Learning Tutorial/ Assignments (2 hours/week × 6 weeks)	12
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	 32 8 20
Formal Assessment a) Continuous Assessment b) Final Examination	 3 3

Total	120
TEACHING METHODOLOGY	
Lecture and Discussion, Problem-Based Method	
COURSE SCHEDULE	

Week	Lecture	Topics to be Covered	Assessment
1	01	Introduction to Concrete, Reinforced Concrete and prestressed concrete, load according to BNBC-2016.	
	02	Introduction to strength design and alternate design methods,	
	03	Safety provision of ACI Code, serviceability.	
2	04	Fundamental assumption of RC concrete, Behavior under axial load	CT 1
	05	Design example.	
	06	Materials, properties under compression, shrinkage, temperature, stress strain curve, relaxation etc.	
3	07	Flexural analysis and design of beam, bending of homogenous beam	
	08	RC concrete beam behavior.	
	09	Design example.	
4	10	Design of tension reinforced rectangular beam, ACI Code Provisions	
	11	Under reinforced, over-reinforced beam, minimum reinforcement ratio.	
	12	Design of Singly reinforced beam	
5	13	Design example of singly reinforced beam	
	14	Design aid, Practical consideration in the design of beam,	
	15	Rectangular beam with tension and compression.	
6	16	Doubly Reinforced beam analysis	
	17	Design example of doubly reinforced beam.	
	18	Design example of doubly reinforced beam.	Mid Term Exam
7	19	T-beam analysis	
	20	Effective flange width, strength analysis.	
	21	T-beam analysis	
8	22	T-beam design example	
	23	Shear and diagonal tension in beams. Diagonal tension in homogenous elastic beams	
	24	Reinforced concrete beam without shear reinforcement	CT 2
9	25	ACI code provision for shear design	
	26	Design Example.	
	27	Design of web reinforcement.	
10	28	Design problems.	
	29	Analysis and design of slab, design of one-way slab.	
	30	Temperature shrinkage reinforcement, Design example of one-way slab.	
11	31	Design example and detailing of one way slab.	
	32	Behavior of two way edge supported slab, column	

		supported slab.	
	33	Design procedure of slab using various methods.	
12	34	Introduction to moment coefficient method	CT 3
	35	Design example of two-way slab using moment coefficient method.	
	36	Design example of two-way slab using moment coefficient method.	
13	37	Design example of two-way slab using moment coefficient method.	
	38	Design and reinforcement detailing of two-way slab.	
	39	Bond and anchorage and Development length, fundamental of flexural bond.	
14	40	Bond strength and development length, anchorage requirement for web RCC.	
	41	Bar cut-off and bent point of beams, Bar splices.	
	42	Design example of development length.	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/Active Class Participation)	40%	CO1, CO2, CO3	C2, C4.C5
Final Exam	60%	CO1, CO2, CO3	C2, C4.C5
Total Marks	100%		

REFERENCE BOOKS

1. Reinforced Concrete: Mechanics and Design – James Wight and James MacGregor, 6th Ed.
2. Design of Concrete Structures – Nilson (12th Edition).
3. Design of Concrete Structures – Nilson, David & Dolan, 14th Ed.
4. BNBC 1996, 2006, 2015, 2020.

COURSE INFORMATION	
Course Code: CE 386	Credit Hour: 1.5
Course Title: Civil Engineering Structures Design Sessional	Contact Hour: 3.0

PRE-REQUISITE

EWCE-213 (Structural Analysis I), CE-385 (Design of Civil Engineering Structures I)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This is the class room design sessional where students will be guided to design and detail of different components of a low-rise masonry structure, slab bridge and balanced cantilever bridge.

OBJECTIVE

1. To apply basic concept of limit state design to determine design load
2. To design the elements of a low-rise masonry building.
3. To design the various structural components of a slab bridge and a balanced cantilever bridge as per Bridge Design Specification.

COURSE CONTENT

Design of slab bridge, balanced cantilever bridge (AASHTO LRFD 2012) and low-rise

building using ACI code.													
SKILL MAPPING (CO – PO MAPPING)													
No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: **Apply** the basic concepts of limit state design			√									
2	CO2**: Design** the elements of a low-rise masonry building			√									
3	CO3**: Design** of various structural components of a slab bridge and a balanced cantilever bridge as per Bridge Design Specifications.			√									

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	**Apply** the basic concepts of limit state design	1	C3	1	-	1, 3	Report, Class Test, Quiz
CO2	**Design** the elements of a low-rise masonry building	3	C5	1	-	4	Report, Class Test, Quiz
CO3	**Design** of various structural components of a slab bridge and a balanced cantilever bridge as per Bridge Design Specifications.	3	C5	1,2	-	4,5,6	Report, Class Test, Presentation, Final Quiz

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning ▪ Lecture (3 hours* 12 weeks)	36

Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 3 12 3
Formal Assessment • Continuous Assessment • Final Examination	 3 3
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Topics to be Covered	Assessment
1	Introduction to the design of a masonry building following BNBC guidelines and design of slab of a low rise masonry building.	
2	Design of Beam	
3	Design of Stairs	
4	Design of sunshade and lintel	
5	Design of Foundation	
6	Quiz	Mid Term Quiz
7	Introduction on bridge design and Design of Slab Bridge with detailing	
8	Introduction to the design of a balanced cantilever bridge. Design of deck slab and railing of a balanced cantilever bridge.	
9	Analysis of Interior Girder for dead loads and live loads	
10	Analysis of Interior Girder for dead loads and live loads	
11	Design of Interior girder	
12	Design of Exterior girder and diaphragm	
13	Design of articulation.	
14	Quiz and Viva	Final Quiz

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ Presentation/ Mid Term/ Active Class Participation)	50%	CO1, CO2, CO3	C3, C5
Final Quiz	50%	CO1, CO2, CO3	C3, C5
Total Marks	100%		

REFERENCE BOOKS

1. Design of Concrete Structures by Nilson (10th, 12th and 15th Edition)
2. Bangladesh National Building Code (BNBC) - 2012
3. AASHTO LRFD Bridge: Design Specifications 2012

COURSE INFORMATION	
Course Code: CE 387	Credit Hour: 4.0
Course Title: Design of Civil Engineering Structures II	Contact Hour: 4.0

PRE-REQUISITE

EWCE 101 (Analytical Mechanics), EWCE 211 (Mechanics of Solids), CE 385 (Design of Civil Engineering Structures I)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

It is the second design course for reinforced concrete structures after CE 385. In this course students will continue to learn how to design various components of reinforced concrete building, such as short column, slender column, footing, pile caps, retaining wall, shear wall, etc. which will be necessary at later semester for projects, as well as professionally.

OBJECTIVE

1. To obtain skill in designing different reinforced cement concrete (RCC) building components such as column, shear wall and footings under different types of loading
2. To understand the fundamental behavior of structural steel and design provision of tension and flexural members
3. To gain fundamental knowledge on prestressed concrete.

COURSE CONTENT

Design of columns under uniaxial and biaxial loading, structural design of footings, pile caps, design of RCC shear wall. Prestressed Concrete: concepts of prestressing, materials, anchorage systems, analysis of sections for flexure and shear, design of prestressed concrete beam. Behavioral principles and design of structural steel, design of tension members, bolted and welded connections, flexural members, design of beam-columns, connection design, moment connections, detailing of steel structures.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to **understand** basic behavior of prestressed concrete and structural steel material.	√											
2	CO2: Be able to design building components such as reinforced cement concrete (RCC) column and shear wall		√	√									
3	CO3: Be able to design footing and retaining wall		√	√									
4	CO4: Be able to **design** different structural steel members such as truss chord, beam and determine the connection requirement		√	√									

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to understand basic behavior of prestressed concrete and structural steel material.	1	C2	1	-	5,6	Class Test, Mid Term, Final Exam
CO2	Be able to design building components such as reinforced cement concrete (RCC) column and shear wall	3	C4, C5	1	-	5,6	Presentation/ Mid-term, Final Exam
CO3	Be able to design footing and retaining wall	3	C4, C5	1	-	3	Assignment, Class Test, Final Exam
CO4	Be able to design different structural steel members such as truss chord, beam and determine the connection requirement	3	C4, C5	1	-	3	Assignment, Class Test, Final Exam

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile

*Level of Bloom's Taxonomy:

C1 – Remember	C2 – Understand	C3- Apply	C4 – Analyze	C5 - Evaluate	C6 – Create

(T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (4 hours/week × 14 weeks)	56
Guided Learning Tutorial/ Assignments (2.5 hours/week × 6 weeks)	15
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	 38 13 32
Formal Assessment a) Continuous Assessment b) Final Examination	 3 3
Total	160

TEACHING METHODOLOGY

Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Introduction to column, axial compression	
	02	Lateral ties and spiral	
	03	Design example of rectangular tied column	
2	04	Design example of spiral column, spiral design for circular column	CT 1
	05	Strain compatibility analysis and interaction diagram	
	06	Strain compatibility analysis and interaction diagram (contd)	
3	07	Design example of column strength interaction diagram	
	08	Design of column under uniaxial loading	
	09	Biaxial bending, Reciprocal load Method	
4	10	Design discussion on various foundation	
	11	Footing and foundation: design of wall footing	
	12	Single column footing	
5	13	Rectangular footing (contd)	
	14	Design of combined footing	
	15	Design of shear wall	
6	16	Design of shear wall (contd)	
	17	Analysis and design of two way slab	
	18	Analysis and design of two way slab	Mid Term Exam
7	19	Introduction to prestress concrete	
	20	Three concepts of prestressed concrete	
	21	Three concepts of prestressed concrete (contd)	
8	22	Three concepts of prestressed concrete (contd)	
	23	Prestressing systems and end anchorage	CT 2
	24	Loss of prestress concrete	
9	25	Loss of prestress concrete	
	26	Loss of prestress concrete (contd)	
	27	Loss of prestress concrete (contd)	
10	28	Analysis of prestress flexural members	
	29	Analysis of prestress flexural members (contd)	
	30	Analysis of prestress flexural members (contd)	
11	31	Design of prestress flexural members	CT 3
	32	Design of prestress flexural members (contd)	
	33	Design of prestress flexural members (contd)	
12	34	Introduction to steel structure, property of steel.	
	35	Advantage and disadvantage of steel structure over RCC structure. Introduction to composite structure.	
	36	Limit states for tension member.	
13	37	Analysis of tension member, bolted connection	
	38	Analysis based on bolt limit state	
	39	Welded connections, types of weld, weld capacity calculation	
14	40	Introduction to compression member, axial capacity of column.	
	41	Design of compression member.	
	42	Introduction to flexure member, bending capacity of beam.	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy

Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C4, C5
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C4, C5
Total Marks	100%		

REFERENCE BOOKS

1. Reinforced Concrete: Mechanics and Design – James Wight and James MacGregor, 6th Ed.
2. Design of Concrete Structures – Nilson (12th Edition)
3. Design of Concrete Structures – Nilson, David & Dolan, 14th Ed
4. BNBC 1996, 2006, 2015, 2020

5.5. Courses Offered by Department of Computer Science and Engineering (CSE)

COURSE INFORMATION	
Course Code: CSE 278	Credit Hour: 1.5
Course Title: Computer Programming and Computation Sessional	Contact Hour: 3.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
The Structured Programming Language Sessional course is designed to practically introduce the fundamental principles, and mechanism of programming skills and develop basic programming skills for program design and development. The lab begins with practicing introductory concepts of structured programming language and then covers other important topics related to structured programming language.	
OBJECTIVE	
1. To learn basic ideas of programming languages. 2. To learn how to program with C. 3. To learn how to think about the problems, and their solutions and translate them to programming language using other languages like C++ and MATLAB Programming in the future.	
COURSE CONTENT	
Basic programming Structures: Mathematical problems using printf, scanf, Data types and their memory allocation, Operators, Expressions, Basic Input/output, Data type conversion; **Control Structure:** Practice problems on —if else‖, —switch‖, Flow Charts, Loop, Nested Loop; **Arrays:** Practice problems on One- dimensional array, Multi-dimensional array, Character array/ string; **Function:** Practice problems on Function, Parameter Passing Convention; **Recursion:** Practice problems on recursion**; Pointer:** Practice problems on Different types of pointers, Pass pointer as arguments, Call by value vs call by reference; **Dynamic Memory Allocation:** Dynamically allocate memory using Malloc, Calloc, Free, Realloc; **User defined data types:** Practice problems on Structures, Unions, Enumerations; **File I/O:** Read, write, append in file; **Header Files and Preprocessors:** Header files, Preprocessor; **Error Handling:** Exception handling; Introduction to MATLAB; Introduction to hi-level computational programming tools, application to numerical analysis: basic matrix computation, solving systems of linear equations, non-linear equations, transcendental equations.	

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Discuss algorithms and **solve** problems using computers	√											
2	CO2: **Analyze** the fundamental principles, typical characteristics, and mechanisms of a structured programming language practically.			√									
3	CO3: **Apply** practical												

	knowledge to develop basic programming skills with respect to program design and development.			√									
4	CO4: Ability to **apply** numerical analysis to engineering problems.		√										

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom’ s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Discuss algorithms and **solve** problems using computers.	1	C1-C3	1	-	5	Final Exam, Class Test, Assignment
CO2	**Analyze** the fundamental principles, typical characteristics, and mechanisms of a structured programming language practically.	3	C4	3	-	7	Final Exam, Class Test, Assignment, Quiz
CO3	**Apply** practical knowledge to develop basic programming skills with respect to program design and development.	3	C6	1,3	-.	7	Assignment
CO4	Ability to **apply** numerical analysis to engineering problems.	2	C3	3	-	2,3	Final Exam, Assignment, Quiz

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA=
Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile
*Level of Bloom’s Taxonomy:
C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create

(T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning	
Lecture (1.5 hours/week × 14 weeks)	21
Class Assignment (1.0	14

hours/week × 14 weeks)	
Guided Learning Assignment Preparation (1 hour/week x 14 weeks)	14
Independent Learning Preparation for tests and examinations	6
Assessment Quiz +Viva	5
Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Problem-Based Learning (PBL)

COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	1	Mathematical problems using printf, scanf	Report, Assignment/Class Test
2	2	Practice Problems on ―if else‖, ―else if‖, ―switch	
3	3	Control Structure: nested if-else	
4	4	Control Structure: loop- For, Do While	
5	5	Control Structure: nested loop	
6	6	Array: one-dimensional array, multi-dimensional array, character array/ string	
7	7	Mid Quiz	Mid term
8	8	Recursion	Report, Assignment/Class Test
9	9	Practice problem on User Defined Data Types: Structure, Union	
10	10	Final Quiz and Viva	Final Exam/Project, Viva
11	11	Introduction to MATLAB: MATLAB environment, matrices, function, loop, file I/O	Report, Assignment
12	12	Solving non-linear algebraic and transcendental equations using Numerical Methods in MATLAB	
13	13	Solving non-linear algebraic and transcendental equations using Numerical Methods in MATLAB	
14	14	Final Quiz on MATLAB	Final exam

ASSESSMENT STRATEGY				
Components		**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment	Lab Report/Lab Test/ Assignments	20%	CO1, CO2, CO4	C1-C3, C4
	Class Participation	5%	CO1, CO2, CO3, CO4	C1-C3, C4, C6
	Online Test	20%	CO1, CO2	C1-C3, C4
	Mid Quiz	20%	CO1, CO2, CO3	C1-C3, C4, C6

Final Quiz and Viva	35%	CO1, CO2, CO3, CO4	C1-C3, C4, C6
Total Marks	100%		
REFERENCE BOOKS			

1. Teach Yourself C (3rd Edition) by Herbert Schidlt
2. Programming in Ansi C (6th Edition) by E Balagurusamy
3. C: The Complete Reference (4th Edition) by Herbert Schildt
4. C Programming Language (2nd Edition) by Dennis M. Ritche
5. Numerical Methods for Engineers and Scientists – J. D. Hoffman
6. App. Numerical Methods with Matlab for Engrs and Scientists – S.C. Chapra.
7. Numerical Mathematical Analysis – James b. Scarborough
8. Introductory Methods of Numerical Analysis – S.S. Sastry
9. Numerical Methods for Scientific and Eng. Computation - Jain, Iyengar, Jain.

5.6. Courses Offered by Department of Electrical, Electronic and Communication Engineering (EECE)

COURSE INFORMATION	
Course Code: EECE 167	Credit Hour: 3.0
Course Title: Basic Electrical Technology	Contact Hour: 3.0

PRE-REQUISITE

None.

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

To gain basic knowledge on basic AC and DC electrical circuits, electrical machines and also their principle of operation, characteristics and applications.

OBJECTIVE

1. To develop the basics of electrical circuits and different problems solving techniques.
2. To impart the basic operating principle of electrical machines like DC motor, DC generator and Transformer etc.
3. To impart the concept of active, reactive and apparent powers, power factor and resonance in series and parallel circuits.
4. To introduce with electrical wiring consideration and basic service design concepts.

COURSE CONTENT

Electrical units and standards, Electrical networks and circuit solutions: Series, parallel, node and mesh current analysis. Measurement of electrical quantities: Current, voltage, resistance, Measuring instruments: Ammeters, voltmeters, watt meters and multi-meter. AC circuit analysis: Instantaneous current, voltage and power, effective current and voltage, average power. Phasor algebra: Single phase RLC circuits, balanced three phase circuits. Introduction to electrical wiring for residential and commercial loads. (Illumination and lighting, Air Conditioning, heating, lifts, intercom, public address system, telephone system and LAN, security system including CC TV, stand by generator and substation design considerations.) Basic principles and application of different types of electrical machines (Generator, motor, alternator, and transformer) Introduction to Electronics devices with simple application: Diodes, rectifiers.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to apply network theorems to simplify real life complex networks.		√										
2	CO2: Be capable to explain the structure, operating principle and main features of electrical machines and their applications.	√											
3	CO3: Be able to understand AC circuit concepts and solve both single phase and three phase circuit problems.		√										
4	CO4: Be able to discover the basic idea of wiring design and electrical appliances.			√									

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to apply network theorems to simplify real life complex networks.	1	C3	1	-	3	Class Test, Final Exam
CO2	Be capable to explain the structure, operating principle and main features of electrical machines and their applications.	1	C2, C4	1	-	1,3	Class Test, Mid-term, Final Exam
CO3	Be able to understand AC circuit concepts and solve both single phase and three phase circuit problems.	2	C2, C5	1	-	3	Assignment, Mid Term, Final Exam
CO4	Be able to discover the basic idea of wiring design and electrical appliances.	3	C2	1	-	5	Assignment, Final Exam
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R –Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 14 weeks)	42
Guided Learning Tutorial/ Assignments (2 hours/week × 6 weeks)	12
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	11 18 32
Formal Assessment c) Continuous Assessment d) Final Examination	2 3
Total	120

TEACHING METHODOLOGY			
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method			
COURSE SCHEDULE			
Week	**Lecture**	**Topics to be Covered**	**Assessment**
1	01	Basic idea about Electrical Circuit, Circuit variables and elements	CT1
	02	Applications of electrical circuits, Introduction to basic laws of circuits	
	03	Nodes, Branches, Loops, Voltage divider law and examples	
2	04	Current divider law and examples, Wye-Delta transformation	
	05	Methods of circuit analysis, Nodal analysis and examples	
	06	Mesh analysis and examples, Super node with examples, Basic circuit theorems	
3	07	Super mesh with examples, Nodal VS Mesh analysis	CT2
	08	Superposition theorem, Thevenin's theorem with examples	
	09	Norton's theorem with examples, Maximum power transfer in a circuit	
4	10	Introduction: Concept of phasor and complex impedance / admittance	
	11	Introduction: Concept of phasor and complex impedance / admittance	
	12	Analysis of simple series and parallel circuits	
5	13	Theory of Active power, reactive power, apparent power (volt ampere)	MID Term Exam
	14	Mathematical Problems of Active power, reactive power, apparent power (volt ampere)	
	15	Power factor and energy associated with these circuits	
6	16	Concept of complex power, Phasor diagram	
	17	Impedance triangle and power triangle associated with complex circuits.	
	18	Resonance in series and parallel circuits	
7	19	Synchronous Generator: Operating principle, Losses in Alternator	
	20	Equivalent circuit of synchronous Generator, Excitation systems of Synchronous Generator	
	21	Emf equation of synchronous generator, Mathematical problems	
8	22	Three phase induction motor: principle, Rotating magnetic field	CT3
	23	Construction of squirrel cage IM, equivalent circuit, vector diagram, torque-speed characteristics	
	24	starting and braking, speed control, starting and torque speed characteristics	
9	25	Synchronous motor: Operation, Starting method of synchronous motor	
	26	Vector diagrams of synchronous motor	
	27	Effect of loading under different excitation condition.	
10	28	Introduction to semiconductor devices and its classifications	

	29	P-type and N-type materials and doping, Semiconductor diode and its band diagram	
	30	Biasing of semiconductor diodes, I-V characteristics of diode and equivalent circuit of diodes, Zener diode and related maths of zener diode.	
11	31	Introduction to BJT and construction, Principle and operation of BJT	
	32	Operating regions of BJT and its different configurations	
	33	CB and CE configurations and characteristics curves, Mathematical problems related to CB and CC configurations.	
12	34	Measuring instruments: Ammeters, voltmeters	
	35	watt meters and multi-meter	
	36	Analysis of three phase circuits: Three phase supply	
13	37	Balanced and Unbalanced circuits, Power calculation	
	38	Balanced and Unbalanced circuits, Power calculation	
	39	Introduction to electrical wiring for residential and commercial loads. Illumination and lighting, Air Conditioning	
14	40	Heating, lifts, intercom, public address system, telephone system and LAN	
	41	Security system including CC TV, stand by generator and substation design considerations	
	42	Review Class	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C3, C4, C5
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C3, C4, C5
Total Marks	100%		

REFERENCE BOOKS

1. Alternating-Current Circuits by Russell M., Corcoran, George F. Kerchner
2. Fundamentals of Electric Circuits by Charles Alexander, Matthew Sadiku

5.7. **Courses Offered by Department of Mechanical Engineering (ME)**

COURSE INFORMATION	
Course Code: ME 142	Credit Hour: 1.5
Course Title: Workshop Sessional	Contact Hour: 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will be introduced with different wood working tools, bench tolls, hand tools and machine tools. Students will be also presented with welding techniques. This training will be useful for the students in later projects.

OBJECTIVE

1. The student will be able to use different manufacturing (machining, welding, foundry, sheet metal working, etc.) processes required to manufacture a product from the raw materials.
2. He will be able to use different measuring, marking, cutting tools used in workshop.
3. He will be aware of the safety precautions while working in workshop.

COURSE CONTENT

Machine shop: (3/4 hrs/week)

Kinds of tools, common bench and hand tools, marking and layout tools, measuring tools, cutting 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 hrs/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, aluminum, 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 flame, welding of different types of materials, Gas welding defects, test of gas welding.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to study the basics of workshop engineering practice.	√											
2	CO2: Be able to identify the hand tools and instruments and acquire measuring skills.					√							
3	CO3: Be able to acquire practical skills by performing the experiments in different shops of workshop.				√								

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to study the basics of workshop engineering practice.	1	C1	1		1	Report, Mid Term Exam, Assignment
CO2	Be able to identify the hand tools and instruments and acquire measuring skills.	5	C1	1		1	Report, Mid Term Exam, Assignment
CO3	Be able to acquire practical skills by performing the experiments in different shops of workshop.	4	C3	1		1,5	Report, Final Exam, Assignment

**Level of Bloom's Taxonomy:*

C1 - Remember | C2 - Understand | C3 - Apply | C4 - Analyze | C5 - Evaluate | C6 - Create

(CP – Complex Problems, CA – Complex Activities, KP – Knowledge Profile, T – Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R – Report, F – Final Exam, Viva - V)

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (3 hours/week × 12 weeks)	36
Guided Learning Tutorial/ Assignments (1 hours/week × 12 weeks)	12
Self- Directed Learning a. Non-face-to-face learning b. Revision of the previous lecture at home c. Preparation for final examination	 1 2 3
Formal Assessment a. Continuous Assessment b. Final Examination/Quiz and Viva	 4 2
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Introduction	Report, Mid Quiz, Viva
2	02	Study of Electric Arc welding process and various types of joint	
3	03	Study on different types of joint by TIG welding and MIG welding	

4	04	Study of Gas welding, Gas cutting, Soldering and Brazing	
5	05	Study of Lathe Machine and Its Various Operations	
6	06	Study of Milling Machine and Its Various Operations	
7	07	Mid Quiz	
8	08	Study of Shaping Machine and Its Various Operations	Report, Final Quiz, Viva
9	09	Study of Drilling Machine and Its Various Operations	
10	10	Study of Grinding Machine and Its Various Operations	
11	11	Study on Sand Mold Preparation using single piece pattern	
12	12	Study on Split Pattern and Various Types of Molding Sand Properties	
13	13	Study on single pattern double mold preparation and various types of casting defects	
14	14	Final Quiz	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Assignment/Test/ Mid Term/ Active Class Participation)	45%	CO1, CO2, CO3	C1
Quiz	50%	CO1, CO2, CO3	C3
Viva	5%	CO1, CO3	C1
Total Marks	100%		

REFERENCE BOOKS

1. Machine Shop Practice, Vol. 1- Moltrecht, Karl
2. Farm and Workshop Welding- Andrew Pearce

5.8. Courses Offered by Department of Industrial and Production Engineering (IPE)

COURSE INFORMATION	
Course Code: GELM 275	Credit Hour: 2.0
Course Title: Leadership and Management	Contact Hour: 2.0
PRE-REQUISITE	
None	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
The course is designed to make students understand the overlapping connection between engineering and management in an organization through the study of varied management practices and leadership traits as an engineer.	
OBJECTIVE	
To introduce different management functions and approaches. 1. To expose students to different views and styles of leadership 2. To understand how an organization functions collaboratively with managers and engineers. 3. To understand various personality traits and its impact on leadership and management. 4. To solve real-world management problems as an engineer.	
COURSE CONTENT	
a. Main Contents: Introduction to Leadership and Management, Management Fundamentals, Leadership & Motivation, Organizational Management, Planning and goal setting, Control, Change and Innovation, Attitude, Personality, Perception and Individual Decision Making, Understanding Work Team, HR Management, Operations Management, Information Technology and Management, Case studies. b. Detailed Contents: Introduction to Leadership and Management: Definition of leadershipand management, basic difference between a leader and a manager, relation of leaders and managers with respect to efficiency and effectiveness, qualities of leader and managers with examples from history. Management Fundamentals: Definition of management & manager, levels of management, management functions and skills, Mintzberg's managerial roles, Henri Fayol's management principles, strategic management. Leadership & Motivation: Motivation, Maslow's hierarchy needs, theory of X & Y, motivators and hygiene factors, goal setting theory, reinforcement theory, equity theory, expectancy theory, Leadership styles, leadership trait theory, managerial grid, contemporary leadership, conflicts negotiation, leadership issues in 21st century, cross cultural leadership, engineer as a leader and some simple case discussions on leadership (positive and toxic leadership) in the class (Interactive Learning). Organizational Management: Organization, departmentalization, chain of command, unity of command, cross functional area, authority, centralization and decentralization, traditional & contemporary organization, matrix project structure, learning structure, organizing collaboration. Planning and goal setting: Foundation of planning, goals of plan, types of goal, types of goal & plan, goal setting, MBO, well written goal. Control: Controlling process, controlling for organizational performance, types of control: (feed-forward, feedback & concurrent), balanced scorecard, contemporary issues in control, workplace concern & workplace violence. Change and Innovation: Change and innovation, internal and external for change, changing process, creativity vs innovation. Attitude: Components of Attitude, behavior model and characteristics model, behavior vs. attitude, job attitude, job involvement, job satisfaction and customer satisfaction.	

Personality: Personality determinants: heredity and environment, Myers-Briggs Type Indicator,Big five personality model, personality traits (core self-evaluation, Machiavellianism, narcissism, self-monitoring, risk taking, proactive personality).
Perception and Individual Decision Making: Factors influencing perception, attribution theory, errors/biases in attribution, Factors of individual decision making, rational decision making, bounded rationality, satisfice, common errors in decision making, creativity in decision making.
Understanding Work Team: Work group, work team, problem solving team, selfmanaged workteam, cross functional team, virtual team, team effectiveness, team challenges.
HR Management: Process of Human Resource Planning, forecasting demand for labor, staffing, internal supply of labor, performance appraisal.
Operations Management: Project managing basics, goals and boundary of project, WBS, scheduling a project, Demand and supply forecasting, inventory control. Information.
Technology and Management: Management Information System (MIS), Enterprise Resource Planning (ERP) - For introductory knowledge.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	CO1: Be able to familiarize with the fundamental concepts of leadership and management skills									√	√		
2	CO2: Be able to understand the role and contribution of a leader inachieving organizational goals									√	√	√	
3	CO3: Be able to understand the contribution of leadership traits and management skills in decision making and solving real life problems								√	√	√	√	√

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom' s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to familiarize with the fundamental concepts of leadership and management skills	9,10	C1, C2	-	-	1	Class Test, Report, Final Exam
CO2	Be able to understand the role and contribution of a leader in achieving organizational goals	9,10,11	C1, C2	-	-	1	Class Test, Report, Assignment, Final Exam
CO3	Be able to understand the contribution of leadership traits and management skills in decision making and solving real life	8,9,10,11 ,12	C1, C2	-	-	1	Class Test, Report, Assignment, Final Exam

	problems						
	WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile *Level of Bloom's Taxonomy: C1 – Remember C2 – Understand C3- Apply C4 – Analyze C5 - Evaluate C6 – Create (T-Test, PR – Project, Q – Quiz, M – Mid Term Exam, Asg – Assignment, Pr – Presentation, R – Report, F – Final Exam)						

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning Lecture (2 hours/week × 14 weeks)	28
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	10 14 14
Formal Assessment a) Continuous Assessment b) Final Examination	2 3
Total	80

TEACHING METHODOLOGY
Lecture and Discussion, Problem-Based Method

COURSE SCHEDULE

Week	Lecture	Topics to be Covered	Assessment
1	01	Introduction to Leadership and Management: Definition of leadership and management, basic difference between a leader and a manager, relation of leaders and managers with respect to efficiency and effectiveness, qualities of leader and managers with examples from history.	CT 1
	02	Management Fundamentals: Definition of management & manager, levels of management, management functionsand skills, Mintzberg's managerial roles, Henri Fayol's management principles, strategic management.	
2	03 04	Leadership & Motivation: Motivation, Maslow's hierarchy needs, theory of X & Y, motivators and hygiene factors, goal setting theory, reinforcement theory, equity theory, expectancy theory	
3	05 06	Leadership: Leadership styles, leadership trait theory, managerial grid, contemporary leadership, conflicts negotiation, leadership issues in 21st century, cross cultural leadership, engineer as a leader and some simple case discussions on leadership (positive and toxic leadership) in the class (Interactive Learning).	
4	07 08	Case Study – I : Engineer as Great Leaders	

5	09	Organizational Management: Organization, departmentalization, chain of command, unity of command, cross functional area, authority, centralization and decentralization, traditional & contemporary organization, matrix project structure, learning structure, organizing collaboration	
	10	Planning and goal setting: Foundation of planning, goalsof plan, types of goal, types of goal & plan, goal setting, MBO, well written goal.	
6	11	Control: Controlling process, controlling for organizational performance, types of control: (feed-forward, feedback & concurrent), balanced scorecard, contemporary issues in control, workplace concern & workplace violence.	
	12	Change and Innovation: Change and innovation, internaland external for change, changing process, creativity vs innovation	
7	13	Case Study – II: Planning and Goal Setting, A Managerial Approach: Engineer as Great Managers (InteractiveDiscussions in the Class)	
	14	Attitude: Components of Attitude, behavior model and characteristics model, behavior vs. attitude, job attitude, job involvement, job satisfaction and customer satisfaction.	
8	15	Personality: Personality determinants: heredity and environment, Myers-Briggs Type Indicator, Big five personality model, personality traits (core self-evaluation, Machiavellianism, narcissism, self-monitoring, risk taking,Proactive personality).	Mid Term Exam/Project
	16	Perception and Individual Decision Making: Factors influencing perception, attribution theory, errors/biases inattribution	
9	17	Perception and Individual Decision Making: Factors of individual decision making, rational decision making, bounded rationality, satisfice, common errors in decision making, creativity in decision making.	
	18	Case Study – III : A Case on Decision Making – Involves both leadership and managerial skills (Interactive Discussion in the Class)	
10	19	Understanding Work Team: Work group, work team, problem solving team, self-managed work team, cross functional team, virtual team, team effectiveness, team challenges.	CT 3
	20	HR Management: Process of Human Resource Planning,Class Test 2 Forecasting demand for labor, staffing.	
11	21	HR Management: Internal supply of labor, performance Appraisal.	
	22	Operations Management: Project managing basics, goals and boundary of project, WBS, scheduling a project.	

12	23	Operations Management: Demand and supply forecasting, inventory control.	
	24	Exercise – Use of Microsoft Project (MSP) for scheduling a project at student level	
13	25	Case Study – IV: A case that covers all relevant theories taught throughout the course and involves both leadership and management issues, e.g., Columbia's Final Mission. (This may be given as group assignment followed by in class short presentations/discussions)	
	26		
14	27	Information Technology and Management: Management Information System (MIS), Enterprise Resource Planning (ERP) - For introductory knowledge.	
	28	Revision	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2
Final Exam	60%	CO1, CO2, CO3	C1, C2
Total Marks	100%		

REFERENCE BOOKS

1. Students must be provided with SOLID reading material instead of referring text books.
2. However, course teacher may select any text book as per his choice.
3. Engineering Management (Revised Edition) – A.K. Gupta.
4. Industrial Engineering and Production Management - Martand T. Telsang.
5. Leadership in Organizations – Gary Yukl.
6. Developing Management Skills – David A. Whetten and Kim S. Cameron.