MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

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

COURSE CURRICULUM FOR UNDERGRADUATE PROGRAM

2021

Contents

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EWCE Department, MIST

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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 the 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. Intending 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 in Civil Engineering. Bachelor's degree in Computer Science Engineering course has been started in 2001. Bachelor courses in Electrical, Electronic & Communication Engineering and Mechanical Engineering started their journey in 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 contributing to 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 the 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. The pursuit of Innovation-We cultivates 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 the SSC/equivalent examination in Science Group obtaining a GPA of 4.00 (without a fourth subject) on a scale of 5.0 and in HSC/Equivalent examination from the 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 the minimum of five subjects including Mathematics, Physics, Chemistry and English Language with minimum 'B' in average in GCE 'O' Level and '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 the respective Embassy/High Commission in Bangladesh.
(3) Sex: Male and Female.

In the event of the 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)	60
2		Computer Science and Engineering (CSE)	60
3		Electrical, Electronic and Communication Engineering (EECE)	60
4		Mechanical Engineering (ME)	60
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		**570**

The total number is 570. In general, a maximum of 50% of 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	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

The admission test will be conducted based on 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	60
b.	Physics	60
c.	Chemistry	60
d.	English	20
		Total = 200

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

1.6.3. Medical Checkup
Civil candidates selected through the 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 a medical policy of MIST will be declared unsuitable for admission.

1.7. Students Withdrawal Policy

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 10 (ten) regular terms. It is expected that all students will earn the 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 the Academic Council of MIST, a student may be allowed for the third time as last chance.
e. In case of sickness, which leads to missing more than 40% of 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. The 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's 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 conditions of the MIST Examination Policy remain valid.

1.7.2. Withdrawal on Disciplinary Ground

a. **Unfair Means.** Adoption of unfair means may result in the expulsion of a student from the program and so from the Institution. The Academic Council will authorize such expulsion based on the recommendation of the Disciplinary Committee, MIST, and as per the 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 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 the 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 the approval of the 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.

1.8. Course Adjustment for EWCE 06 Batch

According to the revised curriculum, a student will have to complete a total of 160.00 Cr. Hr. to obtain the degree of either B.Sc. in Civil & Environmental Engineering or B.Sc. in Civil & Water Resources Engineering, except for the sixth batch (EWCE-06), who needs to complete 161.00 Cr. Hr. This adjustment has been presented in Chapter 4.

2. RULES AND REGULATIONS FOR UNDERGRADUATE PROGRAM AT MIST

2.1. Introduction

MIST has introduced a course system for undergraduate studies from the academic session 2017-18. The rules and regulations mentioned herein will apply to students for administering the undergraduate curriculum through the Course System. This will be introduced to create 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. The number of theory courses will be generally 5 in each term. However, with the recommendation of the course coordinator and Head of the Department, Commandant MIST may allow relaxation in this regard. This relaxation is to be reported to the Academic Council of MIST.
b. Students will not face any level repeat for failing.
c. Students will get the 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.

Besides the professional courses, about 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 to 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 a maximum of 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

The duration of a Short Term will be around 7 weeks of which about 6 weeks will be spent for class lectures and one week for Term Final Examination. The duration for Short Term and Examination will be as under:

Ser	Events	Durations
1.	Classes	6 weeks
2.	Final Examination	1 week
Total		**7 Weeks**

2.5. Course Pattern and Credit Structure

The undergraduate program is covered by a set of theoretical courses along with a set of laboratory (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. A 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 **Analytic 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 **Basic Electrical Technology**

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 102 **Chemistry Sessional**

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 are 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, several 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 the 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 the 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 the 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 are decided based on 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 for 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. All the students must 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 before 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 that 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 the delay. Acceptable reasons may be medical problems with supporting documents from the Medical Officer of MIST or some other academic commitments that prohibit enrollment before 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. The addition of courses is allowed only within the first two weeks of a regular term and only during the first week of the 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, the application may be considered during the term final examination in the 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 the performance of the student at work during the class, viva-voce during laboratory hours, reports, and quizzes. Besides that, in the end, there will be a final lab test. Each course has a certain number of credits, which describes its corresponding weights. 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 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	-

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

2.17. Course Assessment Strategy

Theory

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 the commencement of the final exam. The rest of the marks will be allotted to the Term Final Examination. The duration of the 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.

The distribution of marks for a given theory course is as follows:

Class Performance	5%
Class Test/ Assignment/ Homework	20%
Mid-Term Assessment	15%
Final Examination	60%
Total	**100%**

Note:

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

Note:

a. *In the 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. The 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 the first two weeks of the beginning of a* *term. The duration of the mid-term examination should not be more than 50 minutes which has to be conducted between the 6^{th} and 9^{th} week of a semester. If the mid-term assessment is done through the project, then there should be a 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. The 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 the term final examination. The date of the practical examination will be fixed by the respective department. Students will be evaluated in the laboratory/sessional courses based on 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 subjects 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 the 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 101	3.00	A	3.75	11.250
MATH 101	3.00	B	3.00	9.000
GEBS 101	2.00	B-	2.75	5.500
EWCE 131	3.00	B	3.00	9.000
CHEM 102	1.50	A+	4.00	6.000
ME 142	1.50	A	3.75	5.625
Total	**18.50**			**63.625**

GPA = 63.625/18.50 = **3.44**

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 disciplines 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 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 grade improvement.

2.24. <u>Classification of Students</u>

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 the 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.

<u>Definition of Graduating Student</u>

Graduating students are those students who will have $\leq$ 24 credit hours 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 the student organization or political party, club, society, etc., other than those set up by MIST authority to enhance student's physical, intellectual, moral, and ethical development. Zero tolerance in regards to sexual abuse and harassment in any form and drug abuse and addiction are strictly observed on 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 a 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 a request has to be supported by a medical certificate from a 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 a year. Supplementary-I is defined as the 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 a 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 the same as the question of the regular examination of that Supplementary Examination (if any). Students can take a maximum of two subjects at a time (two subjects in Supplementary-I and one subject in Supplementary-II) and a maximum of 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 than 'B+' for an improvement course. Among the previous result and improvement examination results, the best one will be considered as the final result for an individual student. However, the performance of all examination i,e previous to improvement examination, shall be reflected in the transcript.

2.32. Rules of Different Examinations

Term Final Examination

Following rules to be followed:

i. Registration to be completed before the commencement of the class. A student has to register for his desired courses paying registration, examination fee, and other related fees.
ii. Late registration will be allowed without penalty within the first 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 the 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 slip 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.

Supplementary Examination

Following rules to be followed:

i. Supplementary-I is defined as the 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 a 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. The maximum grading in the Supplementary Exam will be 'B+'.
vi. No sessional exam will be conducted.
vii. The 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, the 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. Anywho fails twice in a course can only retake it in the regular term for appearing the third time. But anyone fails even after the third time, he/she has to take the approval of the Academic Council of MIST for appearing 4th (last) time in a course and need to pay an 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 5^{th} 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.

Thesis/Design and Research Project

If a student cannot complete the thesis in two consecutive terms, with the recommendation of the supervisor, he/she may continue for the next one/ two term 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 the 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. The highest grade of improvement examination will be 'B+'.

vi. One student is allowed to appear at an improvement exam in 6 (six) courses in his/her whole graduation period taking a maximum of 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 a provisional certificate.

CHAPTER 3

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 an undergraduate degree program and subsequently will go for further enlarging its arena to post graduate degree programs. Concern about the environment is a global issue and environmental issues related to large-scale civil engineering projects need further special attention to minimize the adverse impact on the surrounding environment. For Bangladesh managing the vast water resources for their optimum benefit is very vital for the 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, coastal zones, and their relevancy on the overall environment is a call for time. Realizing this importance and to contribute to 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 staff with having a 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. Also, the programs emphasizing 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 to the country's development projects. All-in-all, within a very short period, 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 the EWCE department comprise a total of 162.50 credit hours and 205.00 contact hours & 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 the 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 the 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 work.

3.5. Awarded Degrees from EWCE Department

EWCE department will offer the following degrees in the 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 may award the first two at present and the third one may be awarded in the future if the situation demands.

3.6. Revision of Course Curriculum

The first course curriculum of the EWCE department was recommended by the 25th academic council of BUP and approved by the 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 the 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 the 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 the CE Department were included in the revised syllabus. The second revision was recommended by the 35th academic council meeting of BUP and approved by the 42nd syndicate meeting of BUP in 2017.

As a part of the continuous development of the course curriculum, the department has revised the syllabus in 2019 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) form the foundation for professional and personal development of the graduates that are expected within few years after graduation. The graduates should:

a. Develop a strong academic foundation for a 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 the 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 the 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 to reason informed by the 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 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.

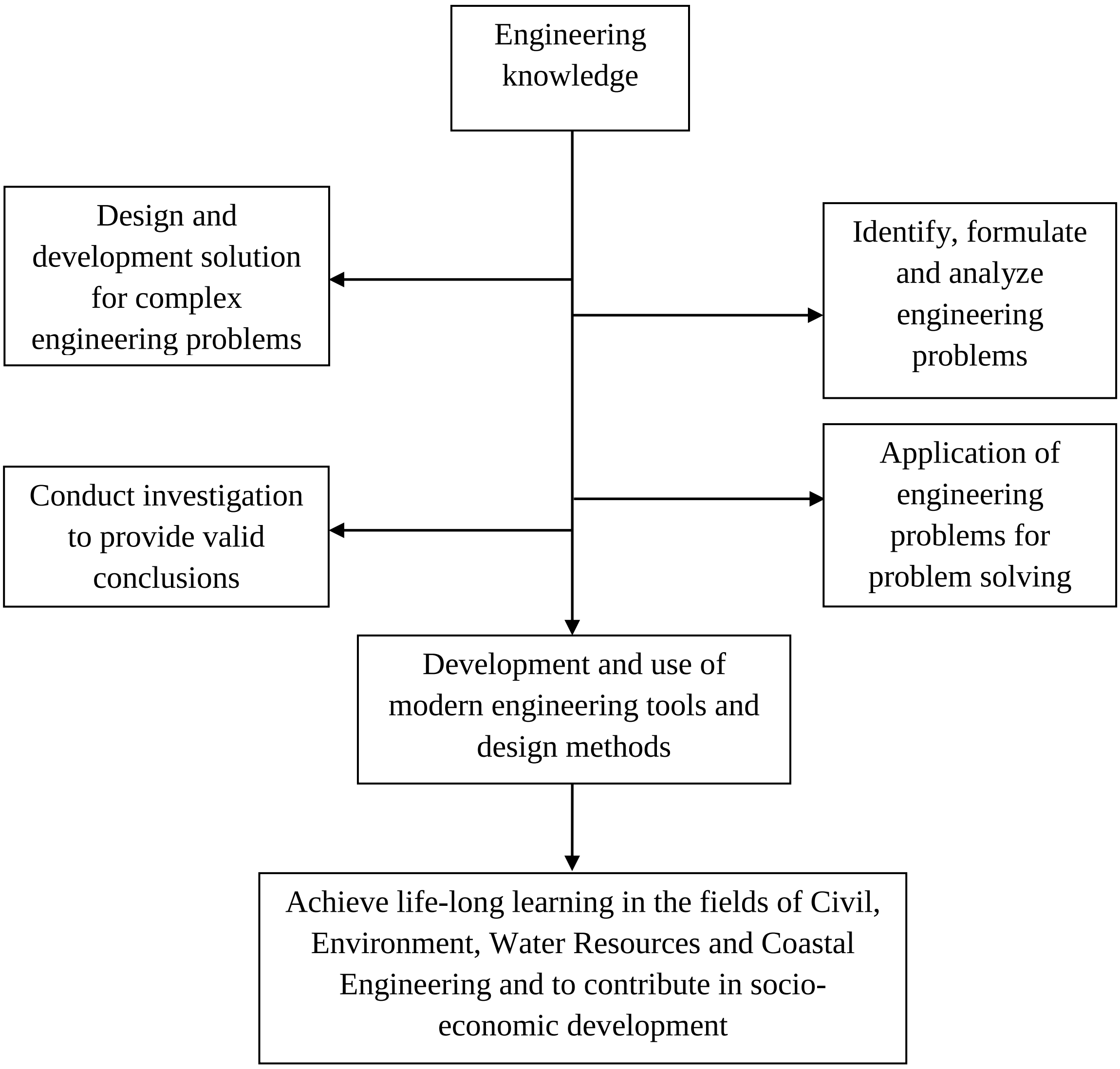
xi. **PO11 Project management and finance**: Able to demonstrate knowledge and understanding of engineering and management principles and apply these to one’s work as a team member or a leader to manage projects in multidisciplinary environments.

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 the spring 2021 session.

4.1. Summary of Course Curriculum (Credit Hours)

Level/ Term	Language	Gen Edu/ Non-skill	Math	Basic Science	Inter-disciplinary	Program Core	Technical Electives	Total
1-I	-	2.00	3.00	3.00+ 1.50	1.50	6.00 +1.50	-	18.50
1-II	1.50	-	3.00	3.00+ 1.50	3.00	6.00+1.50	-	19.50
2-I	1.50	4.00	3.00	-	1.50	9.00+1.50	-	20.50
2-II	-	2.00	3.00	-	-	9.00+4.50	-	18.50
3-I	-	-	-	-	3.00	13.00+4.50	-	20.50
3-II	-	2.00 + 2.00	-	-	3.00 + 1.50	10.00+2.50	-	21.00
4-I	-	2.00	-	-	-	12.00+6.50	-	20.50
4-II	-	-	-	-	-	3.00+4.00	10.00+3.00	20.00
Total Credit Hrs	3.00	14.00	12.00	9.00	16.5	91.50	13.00	159.00
% Of Total Course	1.88%	8.80%	7.55%	5.66%	10.38%	57.55%	8.18%	100%

4.2. Summary of Term wise Theory and Laboratory Courses

Sl	Level	Term	No. Theory Courses	Theory (Cr. Hrs)	No. Lab Courses	Lab (Cr. Hrs)	Industrial Attachment (Cr. Hrs.)	Research and Design Project (Cr. Hrs)	Credit
1	1st	I	5	14	3	4.5	-	-	18.50
2		II	5	15	3	4.5	-	-	19.50
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	15	2	5.0	1.0	-	21.00
7	4th	I	5	14	3	4.5	-	2.0	20.00
8		II	5	13	2	3	-	4.0	20.00
								Total	

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	15.00	9.00	15.00	4.50	24.00	19.50
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	16.00	12.00	16.00	6.00	28.00	22.00
4/I	14.00	13.00	14.00	6.50	27.00	20.50
4/II	13.00	14.00	13.00	7.00	27.00	20.00
Total	**118.00**	**84.00**	**118.00**	**42.00**	**202.00**	**160.00**

4.4.Final Year Research Project (FYA)

Final Year Research Project (FYA) 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 6.00 corresponding to 12.00 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. Term wise Distribution of Courses

4.6.1. Block Syllabus Effective from Spring 2021 Session and onwards (for Batch EWCE -07 and onwards)

Total credit hours: 159.0

LEVEL-1, TERM-I

Course No	Course Name	Type of Course	Credit Hour	Contact Hour
CHEM 101	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	Ecology and Environmental Pollution		3.0	3.0
	Subtotal (Theory)		**15.00**	**15.00**
CHEM 102	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: 19.50, Contact hours: 24.00			

LEVEL-1, TERM- II

Course No	Course Name	Type of Course	Credit Hour	Contact Hour
PHY 101	Waves and Oscillations, Optics and Modern Physics	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 102	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 263	Engineering Hydrology		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 311	Structure Analysis and Design I	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	Principles 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	Soil Mechanics 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		3.0	3.0
EWCE 333	Waste Water Engineering and Sanitation		4.0	4.0
EWCE 343	Geotechnical and Foundation Engineering		3.0	3.0
EWCE 361	Open Channel Hydraulics		3.0	3.0
	Subtotal (Theory)		**16.00**	**16.00**
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		2.0	4.0
	Subtotal (Internship & Sessional)		**6.0**	**12.0**
	Total = Credits: 22.0, Contact hours: 28.00			

$^{+}$ 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 and Design 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 GIS and RS in Environmental and Water Resources Engineering		1.5	3.0
EWCE 400	Final Year Research Project (FYP)	Project	2.0	4.0
		Subtotal (Sessional & Project)	**6.5**	**13.0**
	Total = Credits: 20.50, Contact hours: 27.00			

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	Final Year Research Project (FYP)	Thesis	4.0	8.0
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)	**7.0**	**14.00**
	Total = Credits: 20.00, Contact hours: 27.00			

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	Final Year Research Project (FYP)	Thesis	4.0	8.0
EWCE 466	Hydraulic Structure Design Sessional	Sessional	1.5	3.0
EWCE 468	Water Modelling Sessional		1.5	3.0
	Subtotal (Sessional & Project)		**7.0**	**14.0**
	Total = Credits: 20.00, Contact hours: 27.00			

4.6.2. Block Syllabus Effective for Spring and Fall 2020 Session (for Batch EWCE -06)

Total credit hours: 160.0

LEVEL-1, TERM-I

Course No	Course Name	Type of Course	Credit Hour	Contact Hour
CHEM 101	Chemistry	Theory	3.0	3.0
MATH 107	Differential and Integral Calculus, Matrices		3.0	3.0
HUM 107	English		2.0	2.0
EWCE 101	Analytical Mechanics		4.0	4.0
EWCE 131	Ecology and Environmental Pollution		3.0	3.0
	Subtotal (Theory)		**15.00**	**15.00**
CHEM 102	Inorganic Quantitative Analysis	Sessional	1.5	3.0
HUM 106	Communicative English		1.5	3.0
EWCE 100	Engineering Drawing and CAD Sessional		1.5	3.0
	Subtotal (Sessional)		**4.5**	**9.0**
	Total = Credits: 19.50, Contact hours: 24.00			

LEVEL-1, TERM- II

Course No	Course Name	Type of Course	Credit Hour	Contact Hour
PHY 103	Physics	Theory	3.0	3.0
MATH 109	Differential Equations and Statistics		3.0	3.0
EECE 167	Basic Electrical Technology		3.0	3.0
EWCE 103	Surveying		3.0	3.0
EWCE 105	Environmental Chemistry		3.0	3.0
	Subtotal (Theory)		**15.00**	**15.00**
PHY 104	Physics Lab	Sessional	1.5	3.0
Shop 142	Workshop Sessional		1.5	3.0
EWCE 104	Practical Surveying	Field Work	1.5	3.0*
	Subtotal (Sessional & Field Work)		**4.5**	**9.0**
	Total = Credits: 19.50, Contact hours: 24.00			

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

For rest of the Levels and Terms, revised syllabus from Spring 2021 session will be followed.

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 basic civil engineering components using AutoCAD will be helpful during project work in later semesters, as well as professionally.	
OBJECTIVE	
1. To impart knowledge of different terms, projections, and views in the field of engineering. 2. To make the students efficient in drawing and understanding civil drawings. 3. To gain knowledge about the basic functions of AutoCAD efficiently. 4. To take data and transform it into graphic drawings.	
COURSE OUTCOMES & GENERIC SKILLS	

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **recognize** various drawing instruments and **understand** basic techniques of drawing	PO – 1	C1,C2	1		5, 6	Asg
CO2	Be able to **understand** 2D and 3D views of buildings and hydraulic structures	PO – 1	C2	1, 2		5, 6	T, Asg
CO3	Be able to **draw** different views of structural elements.	PO – 1	C1	1, 2		3, 4,6	T, Q, Asg
CO4	Be able to **understand** the basic concept of AutoCAD software in engineering applications	PO – 5	C2	1, 2		2, 4,5	T, Asg
CO5	Be able to **apply** the knowledge to draw detail	PO – 1	C3	1, 2,		4,5	T, Q, Asg

	architectural and structural drawing of buildings, Septic Tank, Dam and Culvert			3			
CO6	Be able to **apply** the knowledge to draw sectional view, plan view and elevation of various structures	PO – 1	C3	1, 2		4,5	T, Q, Asg

**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>

(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)

COURSE CONTENT

Lines and lettering, plane geometry: drawing of linear and curved geometric figures, e.g. pentagon, hexagon, octagon, ellipse, solid geometry: the concept of isometric view and oblique view, the theory of projections, drawing of an isometric view of 3d objects, projections of a cube, prism, cone, cylinder, developments of a cube, pyramid, cone, cylinder, plan, elevations and sections of one-storied buildings.

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

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **recognize** various drawing instruments and **understand** basic techniques of drawing	2											
CO2	Be able to **understand** 2D and 3D views of buildings and hydraulic structures	2											
CO3	Be able to **draw** different views of structural elements.		3										
CO4	Be able to **understand** the basic concept of AutoCAD software in engineering applications					3							
CO5	Be able to **apply** the knowledge to draw detail architectural and structural drawing of buildings, Septic Tank, Dam and Culvert	2											
CO6	Be able to **apply** the knowledge to draw sectional view, plan view and elevation of various structures	2											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)			
JUSTIFICATION FOR CO – PO MAPPING			
	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	2	Knowledge of mathematics and natural science has to be applied to understand basic techniques of drawing.
	CO2 – PO1	2	To understand 2D and 3D views of buildings and hydraulic structures, knowledge of natural science and engineering fundamentals is required.
	CO3 – PO2	3	To draw different views of structural elements, the ability to identify and analyze engineering problems is required.
	CO4 – PO5	3	Applying modern engineering tools like AutoCAD software is very much required in engineering
	CO5 – PO1	2	Knowledge of engineering and natural science is required to draw detail architectural and structural drawing of buildings, Septic Tank, Dam, and Culvert
	CO6 – PO1	2	Knowledge of engineering and natural science is required to draw sectional view, plan view, and elevation of various structures

TEACHING AND LEARNING STRATEGY		
	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student-Centered Learning	 12 24 --
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	 24 10 20
	Formal Assessment • Continuous Assessment • Final Examination	 6 14
	Total	110
TEACHING METHODOLOGY		
	Lecture and Discussion, Problem Based Method	

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class	Introduction & Use of Instruments, Lettering/Numbering/Lines/Dimensioning	
Week 2			
	Class	Plane Geometry: Pentagon, Hexagon, Octagon, Plane	

		Geometry: Ellipse, Parabola, Hyperbola	
Week 3			Assignment Mid Term
	Class	Isometric View of 3D Objects Sectional View of 3D Objects	
Week 4			
	Class	Orthographic View of 3D Objects Sectional View of 3D Objects	
Week 5			
	Class	Introduction to Different Parts of a Building Plan and Elevation of One Storied Building	
Week 6			
	Class	Section of One Storied Building	
Week 7			
	Class	Introduction, X-Y coordinate system, Units, and scale. Drawing limits, command basics, drawing and modifying objects, object selection, viewing of objects, drawing aids.	
Week 8			
	Quiz 1		
Week 9			
	Class	Object snap, text writing, hatching, making blocks, dimensioning, object properties, plotting	
Week 10			
	Class	The multi-storied building, all kinds of reinforcement detailing including beam, column, slab, stair	Assignment Mid Term
Week 11			
	Class	Multi-storied building: foundation, plan, elevation, sectional view, detailing	
Week 12			
	Class	Top view, front elevation & cross-section of an embankment, bridge introduction to coastal structures, regulator, aqueduct	
Week 13			
	Class	Introduction to coastal structures, regulator, aqueduct	
Week 14			
	Quiz 2		

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Assignments	15%	CO1, CO4,CO5	C1,C2
	Class Participation	10%	CO1, CO2,CO3	C1,C2,C3
	Mid Term	15%	CO1, CO2	C1,C2,C3
	Final Exam	60%	CO2,CO3,CO4	C1,C2,C3
Total Marks		100%		

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

REFERENCES BOOKS
1. Civil Engineering Drawing - Gurcharan Singh & Subash Chandra. 2. Prathomic Engineering Drawing - Hamonto Kumar Bhottacharjo. 3. Engineering Drawing Basant Agrawal and C M Agrawal. 4. AutoCAD manual.
REFERENCE SITE
http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 101 Course Title: Analytic Mechanics	Credit hours: 3.00 Contact hours: 3.00
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 in order 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 an 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 the inclined axis, a 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, linear momentum and impulse.	

COURSE OUTCOMES AND SKILL MAPPING

No.	COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	Ability to **understand** free body diagram of different types of rigid bodies.	√											

CO 2	Ability to **apply** equations of equilibrium to analyze statically determinate rigid bodies.		√										
CO 3	Ability to **estimate** the geometric properties like centroids, the moment of inertia, etc. of different objects.	√											
CO 4	Ability to **apply** the principles of impulse and momentum,		√										

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **understand** free body diagram of different types of rigid bodies.	1	C2	1		3	Class Test/ Assignment
CO2	Ability to **apply** equations of equilibrium to analyze statically determinate rigid bodies.	2	C3	1		3, 4	Class Test/ Assignment/ Mid-term/ Pop quiz/ Final Exam
CO3	Ability to **estimate** the geometric properties like centroids, the moment of inertia, etc. of different objects.	1	C3	1		3, 4	Class Test/ Assignment/ Mid-term/ Pop quiz/ Final Exam
CO4	Ability to **apply** the principles of impulse and momentum,	2	C3	1		3	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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (4 hours/week x 14 weeks)	42
Guided Learning Tutorial/ Assignments (4 hours/week x 5 weeks)	18
Independent Learning Individual learning (1 hour lecture ≈1.0 hour	33

learning) Preparation for tests and examination	22
Assessment Pop Quiz/Class Test/Mid-Term Exam Final examination	 2 3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lectures	Topics	Assessments
1	1	Resultant and Components of Forces	Assignment, Class Test, Mid-term, Pop quiz, Final Exam
	2	Types of Forces and Introduction to Coplanar Concurrent Forces	
	3	Centroids: Definitions of centroids, the 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	
	11	Tutorial 1(on Forces, Resultant and Components)	
5	13	Tutorial on Analysis of Truss/Frames	
	14	Concept of Moments	
	15	The centroid of a volume (right circle cone, cylinder, hemisphere, etc.)	
6	16	Concept of Parallel Force System	
	17	Determination of Reaction Forces, Forces on Members of Frames	
	18	The 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	The 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 the 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 the 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		
	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**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C3
Final Exam	60%	CO2, CO3,	C3

		CO4	
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.
REFERENCE SITE
http://classroom.google.com/...../.........

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 use various surveying technology and provide basic knowledge of various surveying and mapping projects which will be helpful during project work in later semesters as well as professionally.	
OBJECTIVE	
1. To become technically adept on surveying technology as well as supporting math and science disciplines, 2. To enable the graduates to assist professional land surveyors in various surveying and mapping projects. 3. Technical skills and knowledge acquired from this course will facilitate the graduates to perform their work duties with a commitment to quality, timeliness, and continuous improvement.	
COURSE OUTCOMES & GENERIC SKILLS	

No	Course Outcome	Corresponding POs	Bloom’s Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to **understand** survey techniques and use of survey equipment	PO – 1	C2	1,3		1, 3	T, F
CO2	Able to **use** different topographic survey methods i.e. leveling, traversing, tachometer etc.	PO – 2	C3	2, 3		1, 4	T, M, F

CO3	Able to **apply** the concept of curve setting and route survey i.e. contouring, calculation of area and volume in civil engineering application	PO – 2	C3	2, 3		1, 4	Asg/ T, F
CO4	Able to **understand** the basic concept of map, hydrographic and astronomical survey, GIS, and remote sensing	PO – 1	C2	1, 3		1, 3	Asg, F

**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)

COURSE CONTENT

Fundamentals of surveying, linear measurement, chain surveying, plane table survey, traverse surveying, leveling, calculation of area and volume, topographic survey, trigonometrical survey, tachymetric surveying, curves, and curve setting, project survey.

Special and modern survey equipment (Total station, EDM, RTK-GPS, ADCP, Echo-sounder, OBS, etc.).

Hydrographic survey (velocity profile, measurement of velocity and discharge, sounding, tide gauges), photogrammetry, astronomical surveying, GIS, and remote sensing.

SKILL MAPPING (CO – PO MAPPING)

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

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING			
	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science, and engineering fundamentals has to be applied to understand survey techniques and the use of survey equipment.
	CO2 – PO2	3	To identify the problem-specific solutions using first principles of mathematics, natural sciences, and engineering knowledge of different topographic survey methods i.e. leveling, traversing, tacheometry, etc. is required.
	CO3 – PO2	3	To calculate the area and volume in civil engineering application, the concept of curve setting and route survey i.e. contouring needs to be applied.
	CO4 – PO1	3	Ability to understand the basic concept of map, hydrographic and astronomical survey, GIS, and remote sensing which will be required for engineering specialist knowledge.

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	 9 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to surveying, definition. Classification. Importance of Surveying	
	Class 2	Useful Data and Formulae. Calculation of Areas	
	Class 3	Useful Data and Formulae. Calculation of Volumes	
Week 2			

	Class 4	Chain Surveying, Definition. Procedure. Errors in Chaining. Plotting of Details	CT 1
	Class 5	Advantages and disadvantages of Chain Survey. Linear Measurements	
	Class 6	Traverse Surveying, Definition. Prismatic Compass. Surveyor's Compass	
Week 3			
	Class 7	Useful Definitions, Bearings. Local Attraction.	
	Class 8	Useful Definitions, Field Procedure, Plotting of Compass Traverse	
	Class 9	Closing Error and its Adjustment. Characteristics of Closed Traverses. Traverse Chart. Open Traverse	
Week 4			Mid Term Exam
	Class 10	Plane Table Surveying, Definition. Instruments. Procedure. Orientation.	
	Class 11	Methods of Plane Tabling, Radiation. Intersection. Traversing. Resection	
	Class 12	Levels and Levelling Definition. Dumpy Levels. Wye Levels. Levelling Staff Adjustment of Levels I	
Week 5			
	Class 13	Levels and Levelling Definition. Dumpy Levels. Wye Levels. Levelling Staff Adjustment of Levels II	
	Class 14	Definitions of Various Terms. Purpose of Leveling. Procedure of Levelling Operation	
	Class 15	Methods of Calculating Levels. Effect of Curvature and Refraction on Levelling. Errors in Levelling. Accuracy Required in Levelling Operation I	
Week 6			
	Class 16	Methods of Calculating Levels. Effect of Curvature and Refraction on Levelling. Errors in Levelling. Accuracy Required in Levelling Operation II	
	Class 17	Tacheometry or Stadia Surveying,	
	Class 18	Definition- Instruments. Theory. Tacheometric Constants	
Week 7			
	Class 19	Anallatic lens, field procedure, errors and accuracy I	
	Class 20	Anallatic lens, field procedure, errors and accuracy II	
	Class 21	Curves and Curve Ranging, Definition Notations for Circular Curves	
Week 8			
	Class 22	Elements of Circular Curve	
	Class 23	Methods of Ranging Curves. Transition Curves	CT 2
	Class 24	Vertical Curves	
Week 9			
	Class 25	Astronomical Surveying, Definitions	

	Class 26	Systems of Coordinates of Heavenly Bodies	
	Class 27	Astronomical Corrections. Instruments. Time. Equation of Time I	
Week 10			
	Class 28	Astronomical Corrections. Instruments. Time. Equation of Time II	
	Class 29	Azimuth and Bearing of a Survey Line: True Meridian. Latitude. Longitude	
	Class 30	Photogrammetry, Definition. Classification	
Week 11			
	Class 31	Terrestrial Photogrammety. Photo-Theodolite. Works in Terrestrial Photogrammetry I	
	Class 32	Terrestrial Photogrammety. Photo-Theodolite. Works in Terrestrial Photogrammetry II	
	Class 33	Plotting Stereophcrogrammetry. Parallax I	
Week 12			
	Class 34	Plotting Stereophcrogrammetry. Parallax II	CT 3
	Class 35	Aerial Photogrammetry. Scale of Photographs. Compilation and Mapping I	
	Class 36	Aerial Photogrammetry. Scale of Photographs. Compilation and Mapping II	
Week 13			
	Class 37	Hydrographic Surveying, Definition. Soundings. Velocity Profile	
	Class 38	Methods of locating Soundings. Plotting of Soundings. The tides. Discharge measurement I	
	Class 39	Methods of locating Soundings. Plotting of Soundings. The tides. Discharge measurement II	
Week 14			
	Class 40	GIS and Remote Sensing techniques I	
	Class 41	GIS and Remote Sensing techniques II	
	Class 42	Review of Surveying Course	

ASSESSMENT STRATEGY

Components		**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO2.CO3	
	Class Participation	5%	CO1, CO4	
	Mid Term	15%	CO2	
Final Exam		60%	CO1	C2
			CO2	C3
			CO3	C3
			CO4	C2
Total Marks		100%		

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

REFERENCES 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.

REFERENCE SITE
http://classroom.google.com/...../.........

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 the 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 OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO 1	Able to **use** appropriate survey instruments i.e. chain, plane table, level, theodolite, total station, etc. in survey field works	PO – 1	C3	2	3	1, 3	Q.F
CO 2	Able to **analyze** survey data in preparing longitudinal and transverse profiles of a route and contour map of an area	PO – 2	C4	1	1,2	1, 4	Asg, Q, F
CO 3	Able to **work** effectively as an individual and also as a member of a team in survey field works	PO – 9	C3				Asg, F

**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)

COURSE CONTENT

Linear and angular measurement techniques, traverse surveying, leveling and contouring, curve setting, tachometer, 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
CO1	Able to **use** appropriate survey instruments i.e. chain, plane table, level, theodolite, total station, etc. in survey field works	3											
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 also as a member of a team in survey field works									3			

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

Mapping	Corresponding Level of Matching	Justifications
CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to **use** appropriate survey instruments i.e. chain, plane table, level, theodolite, total station etc. in survey field works.
CO2 – PO2	3	In order to analyze the problem specific solutions using first principles of mathematics and engineering knowledge of preparing longitudinal and transverse profiles of a route and contour map of an area etc. is required.
CO3 – PO9	3	To function effectively as a member or leader in diverse teams and in multi-disciplinary settings, the concept of effectively as an individual and also as a member of a team in survey field works will be helpful.

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning	
• Lecture	19
• Practical/ Tutorial/ Studio	95
• Student-Centered Learning	--
Self- Directed Learning	

• Non-face-to-face learning • Revision of the previous lecture at home • Preparation for the final examination	-- 10 18
Formal Assessment • Continuous Assessment • Final Examination	 5 3
Total	150

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method, Hands-on training

COURSE SCHEDULE

Week	Intended Topics to be Covered	Assessment
1	Briefing Survey Equipment handling	Quiz
2	Tachometry and Stadia Survey (Determination of RL)	Quiz
3	Chain Survey, Traverse Survey, Angular Measurement	Quiz
4	Route Survey, Leveling, Calculation of Cut and Fill	Quiz
5	Contouring	Quiz
6	Simple Curve setting	Quiz
7	Combined Curve setting Super-elevation	Quiz
8	House Setting	Quiz
9	Plane Table Survey Leveling Problem	Quiz
10-18	Digital Survey	Quiz
19	Final Quiz and Viva	Final Examination

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom’s Taxonomy
Daily Quiz (for each event)	20%	CO1, CO2	C3,C4
Field performance/ works / attendance	30%	CO3	
Final reports and assignments (for each event)	15%	CO1, CO2	C3,C4
Observations	5%	CO3	
Practical exam (covering all events) and viva	15%	CO1, CO2,CO3	C3,C4
Final Exam	15%	CO1, CO2,CO3	C3,C4
Total Marks	100%		

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

Affective Domain)
REFERENCES BOOKS
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.
REFERENCE SITE
http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 105	Credit Hour: 3.0
Course Title: Environmental Chemistry	Contact Hour: 3.0
PRE-REQUISITE	
CHEM 101, CHEM 102	
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 the 3R (Reuse, Reduce and Recycle) principle. 2. To understand the details of pollutant chemistry in the atmosphere, water, soil, and food as well as their adverse effects on the environment and human health. 3. To describe the process of chemistry involved in water and wastewater treatment plants. 4. To understand the chemical mobilization from anthropogenic sources, like industrialization, agriculture, drug, and food additives.	
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	PO-1	C2	1		1, 3	Asg/T, F
CO2	Ability to **explain** of chemical and biochemical principles of fundamental environmental processes in air, water, and soil.	PO-1	C2	1		1, 3	T, M, F
CO3	Ability to **identify** the elements of pollution, their sources, and how contaminants propagate in environment.	PO-2	C2	1		1, 3	Asg/ T, M, F

CO4	Ability to **apply** basic chemical concepts to analyze chemical processes involved in different environmental compartments.	PO-2	C3	1, 3		3	F

**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>

(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)

COURSE CONTENT

Fundamental of environmental chemistry, Green synthetic chemistry, the 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 the atmosphere, hydrocarbons, and photochemical smog.

Aquatic chemistry: Water properties, the 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
CO1	Ability to **understand** the concept of 3R principle and relate with their day-to-day work environment	2											
CO2	Ability to **explain** chemical and biochemical principles of fundamental environmental processes in air, water, and soil.	3											
CO3	Ability to **identify** the elements of pollution, their sources, and how contaminants propagate in environment.		3										
CO4	Ability to **apply** basic chemical concepts to analyze chemical processes involved in different environmental		3										

	compartments.												

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING			
	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	2	Ability to **understand** the concept of 3R principle and relate with their day-to-day work environment
	CO2 – PO1	3	Ability to **explai**n of chemical and biochemical principles of fundamental environmental processes in air, water, and soil.
	CO3 – PO2	3	Ability to **identify** the elements of pollution, their sources, and how contaminants propagate in environment.
	CO4 – PO2	3	Ability to **apply** basic chemical concepts to analyze chemical processes involved in different environmental compartments.

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 final examination	 9 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY	
	Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to basic environmental chemistry	
	Class 2	Scopes and history of development of environmental chemistry	
	Class 3	Introduction on aquatic chemistry	
Week 2			
	Class 4	Green synthetic chemistry	CT 1

	Class 5	Concept of 3R (reuse, reduce and recycle)	
	Class 6	Physical properties of water	
Week 3			
	Class 7	Composition, structure and evolution of atmosphere	
	Class 8	Carbon cycle and nitrogen cycle	
	Class 9	Chemical properties of water	
Week 4			
	Class 10	Introduction to chemistry of air pollution	
	Class 11	Sources and effects of air pollutants	
	Class 12	Non-aqueous phases in water	
Week 5			
	Class 13	CFCs	Mid Term Exam
	Class 14	Ozone hole and stratospheric ozone depletion	
	Class 15	Complex reactions in aqueous solutions	
Week 6			
	Class 16	Chemical and photochemical reactions in atmosphere I	
	Class 17	Chemical and photochemical reactions in atmosphere II	
	Class 18	Equilibrium problem solving I	
Week 7			
	Class 19	Hydrocarbons and photochemiocal smog	
	Class 20	Introduction to effects of air pollution	
	Class 21	Equilibrium problem solving II	
Week 8			
	Class 22	Greenhouse gas effects	
	Class 23	Aqueous carbonate system I	
	Class 24	Aqueous carbonate system II, Alkalinity and acidity	
Week 9			
	Class 25	Climate change and its consequences	CT 2
	Class 26	Water pollution and pollutants	
	Class 27	Redox equilibria	
Week 10			
	Class 28	Basic introduction to monitoring of air quality	
	Class 29	Organic pollutants in water	
	Class 30	Chemistry of water quality monitoring and water quality standards	
Week 11			
	Class 31	Criteria pollutants and critical pollutants	
	Class 32	Formation and composition of soil	
	Class 33	Nutrients and pollutants in soil	
Week 12			
	Class 34	Analytical methods for monitoring air pollutants	CT 3
	Class 35	Chemical fates of pollutants	
	Class 36	Metal dissolutions and precipitations	
Week 13			
	Class 37	Air quality standards	

	Class 38	Adsorption of metals I	
	Class 39	Adsorption of metals II	
Week 14			
	Class 40	Case study of air pollution incidents/ disasters	
	Class 41	Biochemical properties and impacts of pesticides, insecticides	
	Class 42	Biochemical properties and impacts of anti-biotic and food preservatives	
	ASSESSMENT STRATEGY		

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO2, CO3	C2
	Class Participation	5%		
	Mid Term	15%		
Final Exam		60%	CO1	C2
			CO2	C2
			CO3	C2
			CO4	C3
Total Marks		100%		

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

REFERENCES 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.

REFERENCE SITE

http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 131	Credit Hour: 3.0
Course Title: Ecology and Environmental Pollution	Contact Hour: 3.0
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 cycles, biodiversity loss, and its impacts on the environment.
2. To understand the basics of the pollutant from the atmosphere, water, and soil as well as their adverse effects on the environment and human health.
3. To give basic ideas about environmental rules and standards.
4. To apprehend the preliminary concept of environmental pollution management.

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to **understand** the concept of material transport, energy dissipation, and human induced alteration in bio-geochemical cycles	PO – 1	C2	1	1, 3	T, M, F	
CO2	Ability to **explain** the pollution sources from environmental compartments and impact on biodiversity.	PO – 1	C2	1	1	T, M, F	
CO3	Ability to **understand** the principles of conservation along with environmental rules and regulations.	PO – 6	C2	1, 5	1, 7	Asg/ CT, F	
CO4	Ability to **explain** the basic principles of environmental pollution management	PO – 6, 7	C2	1, 5	1, 6, 7	M, F	

**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)

COURSE CONTENT

Ecology, ecosystem and bio-diversity, food chain and food web, biogeochemical cycles, human influence on biogeochemical cycles. Environmental Pollution, Environmental parameter monitoring, General concepts of pollutants: (nuclear, fossil fuel, air, domestic, agricultural and industrial), adverse effects of pollution, sampling and monitoring of pollutants, Environmental standards, Environmental Pollution Management.
SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (Pos)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Ability to **understand** the concept of material transport, energy dissipation and human induced alteration in bio-geochemical cycles	3											
CO2	Ability to **explain** the pollution sources from environmental compartments and impact on biodiversity.	3											
CO3	Ability to **understand** the principles of conservation along with environmental rules and regulations.						3						
CO4	Ability to **explain** the basic principles of environmental pollution management						2	3					

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Ability to **understand** the concept of material transport, energy dissipation, and human-induced alteration in bio-geochemical cycles
	CO2 – PO1	3	Ability to **explain** the pollution sources from environmental compartments and impact on biodiversity.
	CO3 – PO6	3	Ability to **understand** the principles of conservation along with environmental rules and regulations.
	CO4 – PO6	2	Ability to **explain** the basic principles of environmental pollution management
	CO4 – PO7	3	Ability to **understand** the concept of material transport, energy dissipation, and human-induced alteration in bio-geochemical cycles

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 final examination	9 18 46
	Formal Assessment • Continuous Assessment • Final Examination	2 3
	Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method
COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Basic concept on ecology, Scope and importance of ecology, Ecological levels of organization hierarchy	
	Class 2	Elementary knowledge on ecological factors, Basic characteristics of ecosystem	
	Class 3	Introduction to Environmental Pollution	
Week 2			
	Class 4	Ecosystem structure and components, Ecosystem footprint	CT 1
	Class 5	Basics on biological diversity, Benefit from biodiversity, Threat to biodiversity	
	Class 6	Hydrologic cycle, Water Pollution	
Week 3			
	Class 7	Biological evaluation, nature selection, symbiosis, Influence of geography and geology on biological diversity	Mid Term Exam
	Class 8	Ecological communities and food chain, Types of food chains	
	Class 9	Source of Pollution, Quality of Water	
Week 4			
	Class 10	Energy partitioning in food	

		chains and food webs, Ecological pyramids	
	Class 11	General aspects of biogeochemical cycles	
	Class 12	Layer of Atmosphere	
Week 5			
	Class 13	Carbon cycle	
	Class 14	Nitrogen cycle, Phosphorus cycle	
	Class 15	Air Pollutants, Source of Air pollution	
Week 6			
	Class 16	Sulphur cycle, Nutrient and Eutrophication	
	Class 17	Water Pollutants	
	Class 18	Causes of Soil Pollution	
Week 7			
	Class 19	Sources of water pollutants	
	Class 20	Adverse effects of water pollution	
	Class 21	Soil Pollution Control strategy	
Week 8			
	Class 22	Source of Thermal Pollution	CT 2
	Class 23	Control of Thermal Pollution	
	Class 24	Water quality parameters I	
Week 9			
	Class 25	Source of Nuclear Pollution	
	Class 26	Control of Nuclear Pollution	
	Class 27	Water quality parameters II	
Week 10			
	Class 28	Pollution from Agricultural activities	
	Class 29	Control of pollution from agricultural activities	
	Class 30	Water quality parameters III	
Week 11			
	Class 31	Pollution due to Detergent and dye	
	Class 32	Control of Pollution from detergent and dye	
	Class 33	Water pollution by synthetic polymers	
Week 12			
	Class 34	Water pollution monitoring and Sampling I	CT 3
	Class 35	Water pollution monitoring and Sampling II	
	Class 36	Water pollution by pharmaceuticals	

Week 13			
	Class 37	Air pollution monitoring and Sampling I	
	Class 38	Air pollution monitoring and Sampling II	
	Class 39	Heavy metal pollution in aquatic ecosystem I	
Week 14			
	Class 40	Environmental Laws and Regulations I	
	Class 41	Environmental Laws and Regulations II	
	Class 42	Heavy metal pollution in aquatic ecosystem II	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO3, CO4	C2
	Class Participation	5%		
	Mid Term	15%		
Final Exam		60%	CO1	C2
			CO2	
			CO3	
			CO4	
Total Marks		100%		

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

REFERENCES 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

REFERENCE SITE

http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 200	Credit Hour: 1.5
Course Title: Details of Construction and Quantity Surveying	Contact Hour: 3.0
PRE-REQUISITE	
EWCE 100 (Engineering Drawing and CAD Sessional)	

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 make the students efficient in practical field through site visits and technical sessions.
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	PO – 1	C2	1		3,4	Asg
CO2	Able to **recognize** different aspects of construction through field visit and team work	PO – 9	C1	5		3	T, Asg, M
CO3	Able to **estimate** the total material and cost required for different components of a residential building	PO – 1	C2	2		5,6	T, Asg
CO4	Able to **determine** the material required for different civil engineering structures such as culvert, septic tank, water reservoir and retaining wall	PO – 1	C5	2		5,6	T, Asg, Q

**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>

(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)

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
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	2											
CO4	Able to **determine** the material required for different civil engineering structures such as culvert, septic tank, water reservoir and retaining wall	2											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	2	Knowledge of mathematics and natural science has to be applied to understand the components of substructure and superstructure of a building, properties of construction materials, design loads, framed structure and load bearing wall structure.

	CO2 – PO9	3	Understanding the role as an individual or in a team is very much required to recognize different aspects of construction through field visit and team work.
	CO3 – PO1	2	To estimate the total material and cost required for different components of a residential building, the knowledge of mathematics and engineering are required.
	CO4 – PO1	2	To determine the material required for different civil engineering structures such as culvert, septic tank, water reservoir and retaining wall, the knowledge of mathematics and engineering are required.

TEACHING AND LEARNING STRATEGY		
	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 12 24 --
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 24 10 20
	Formal Assessment • Continuous Assessment • Final Examination	 6 14
	Total	110
TEACHING METHODOLOGY		
	Lecture and Discussion, Problem Based Method	

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class	Introduction, Parts of building, types of building, foundation	
Week 2			
	Class	Brick and Concrete	
Week 3			Assignment
	Class	Estimation of bricks works, FA, CA and Cement in Concrete	
Week 4			
	Class	Stairs, Slabs, Lintel and Arches	
Week 5			
	Class	Plastering, Paints, Varnishes	
Week 6			
	Class	House plumbing system, Design of water tank	
Week 7			

	Class	Calculation of volume of earthwork for road embankment	
Week 8			
	Quiz 1		
Week 9			
	Class	Estimating and cost analysis of a building 1	
Week 10			
	Class	Estimating and cost analysis of a building 2	Assignment
Week 11			
	Class	Estimating and cost analysis of an embankment	
Week 12			
	Class	Estimating and cost analysis of a culvert	
Week 13			
	Class	Estimating and cost analysis of a septic tank	
Week 14			
	Quiz 2		

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Assignments	20%	CO1, CO2,CO3	C1,C2,C5
	Class Participation	20%	CO1, CO2,CO3,CO 4	C1,C2,C5
	Mid Term	30%	CO1, CO2	C1,C2,C5
Final Exam		30%	CO2,CO3,CO 4	C1,C2,C5
Total Marks		100%		

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

REFERENCES 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

REFERENCE SITE

http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 201	Credit Hour: 3.0
Course Title: Construction Materials	Contact Hour: 3.0
PRE-REQUISITE	
Chem 101	
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 become confident at the use of engineering materials in the construction of civil engineering structures.	

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 buildings and other hydraulic structures, properties of construction materials, design loads, framed structure and load bearing wall structure	PO – 1	C2	1		5, 6	T,Q,Asg,F
CO2	Able to **understand** the production process of major engineering materials (bricks, cement etc)	PO – 1	C2	1, 5		5, 6	T, Q, Asg
CO3	Able to **know** the basics of modern, green and high performance civil engineering material	PO – 1	C2	2		3, 4,6	T, Q, Asg
CO4	Able to **use** appropriate method to undertake basic design calculations for concrete mix.	PO – 3	C3	2		2, 4,5 T,	Q, Asg

**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)

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
CO1	Able to **understand** the components of substructure and superstructure of buildings and other hydraulic structures, properties of construction materials, design loads, framed structure and load bearing wall structure	2											
CO2	Able to **understand** the production process of major engineering materials (bricks, cement etc)	3											
CO3	Able to **know** the basics of modern, green and high performance civil engineering material	2											
CO4	Able to **use** appropriate method to undertake basic design calculations for concrete mix.			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	2	Knowledge of mathematics and Engineering have to be applied to understand the components of substructure and superstructure of buildings and other hydraulic structures, properties of construction materials, design loads, framed structure and load bearing wall structure.

	CO2 – PO1	3	In order to understand the production process of major engineering materials (bricks, cement etc), the knowledge of natural science and engineering fundamentals are required.
	CO3 – PO1	2	In order to know the basics of modern, green and high performance civil engineering material the knowledge of natural science and engineering fundamentals are required.
	CO4 – PO3	3	Knowledge of design solution is required to **use** appropriate method to undertake basic design calculations for concrete mix

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 final examination	 09 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY	
	Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			CT 1
	Class 1	Introduction to CE materials	
	Class 2	Brick: Definition, Characteristics, Classification, Manufacturing	
	Class 3	Brick: Brick burning, Tests for bricks, Brick specifications	
Week 2			
	Class 4	Sand: Sources, Classification, Properties, Functions, Substitute	
	Class 5	Sand: Functions, Uses, Tests, Bulking	
	Class 6	Metals & Alloys: Definition, Effect of Impurities, Comparison	
Week 3			Mid Term
	Class 7	Lime: Definition, Properties, Sources, Types, Hydraulicity	
	Class 8	Lime: Classification, Slaking methods,	

		Artificial hydraulic lime	
	Class 9	Mortar& Plaster: Types, Uses, Characteristics, Functions	
Week 4			
	Class 10	Cement: Manufacture, Cement chemistry, Functions, Hydration	
	Class 11	Cement: Major types, Other types, Testing of Cement	
	Class 12	Ferro cement: Components, Uses	
Week 5			
	Class 13	Introduction to Concrete, Concrete Properties	
	Class 14	Shrinkage and Creep of Concrete	
	Class 15	Manufacturing of concrete	
Week 6			
	Class 16	Mix Design of Concrete: Design guidelines	
	Class 17	ACI Mix design of concrete	
	Class 18	ACI Mix design of concrete	
Week 7			
	Class 19	British method of mix design	
	Class 20	Concrete production in Bangladesh	
	Class 21	Concrete in hydraulic structures	
Week 8			
	Class 22	Stress-Strain Behavior: Definition, Figures	
	Class 23	Stress-Strain Behavior: Load-Strain Behavior of materials	
	Class 24	Rubber: Types, Properties, Uses	
Week 9			CT 2
	Class 25	Glass: Functions, Requirements, Properties, Classification, Uses	
	Class 26	Paint: Functions, Constituents, Bases, Characteristics, Types	
	Class 27	Varnish: Functions, Constituents, Characteristics, Types, Process	
Week 10			
	Class 28	wood structures and properties mechanical properties	
	Class 29	shrinkage and seasoning, treatment and durability	
	Class 30	mechanical properties of timber	
Week 11			
	Class 31	Insulating Materials: Classification, Requirements, Types	
	Class 32	Corrosion & Prevention	
	Class 33	Causes & Prevention of corrosion	
Week 12			
	Class 34	Advanced fiber reinforced polymer (FRP)	CT 3

		composites, reinforcement types	
	Class 35	glass fiber, nano tubes	
	Class 36	geotextiles and geo-synthetics,	
Week 13			
	Class 37	Introduction to Coastal Structures	
	Class 38	Materials used for hydraulic structures	
	Class 39	Marine Concrete	
Week 14			
	Class 40	Riprap, Gabions, Geobag and Geotubes used for hydraulic structures	
	Class 41	Materials used for river/sea bank protection	
	Class 42	Review of design problems	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO4	
	Class Participation	5%	CO2	
	Mid Term	15%	CO1, CO3	
Final Exam		60%	CO1	C2
			CO2	C2
			CO3	C2, C3
			CO4	C2, C3
Total Marks		100%		

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

REFERENCES 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.

REFERENCE SITE

http://classroom.google.com/...../.........

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

PRE-REQUISITE

Chem 101, Phy 103

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will be given basic knowledge on typical formations and mineralogical compositions of rock and minerals. Students will be also familiarized

with geomorphological formations.
OBJECTIVE
1. To gain knowledge on the composition of several types of soils, rocks and the seismicity map of Bangladesh. 2. To attain insight on the common geomorphological formations emphasizing on the perspective 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 soils and rocks.	PO – 1	C1	1		1	T, F
CO2	Able to **identify** the proper seismicity measurement scale and zoning map of Bangladesh	PO – 1	C2	1, 3		1, 3	T, M, F
CO3	Able to **understand** and **synthesize** the general trends in geo-morphological formations and its importance in riverine areas of Bangladesh	PO – 1,3	C4	1, 3		1, 4, 5	Asg, T, F

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)

COURSE CONTENT

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 seismic map of Bangladesh, geology of Bangladesh.

Structural geology: faults, types of faults, fold and fold type, domes, basins, erosional process, and 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
CO1	Able to **understand** the typical	3											

	formations and mineralogical compositions of soils and rocks												
CO2	Able to **identify** the proper seismicity measurement scale and zoning map of Bangladesh	3											
CO3	Able to **understand** and **synthesize** the general trends in geo-morphological formations and its importance in riverine areas of Bangladesh	3		2									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals to learn the definition and characteristics of typical formations and mineralogical compositions of rock and minerals.
	CO2 – PO1	3	In order to identify the proper seismicity measurement scale and zoning map of Bangladesh.
	CO3 – PO1	3	To outline the earthquake and seismic map of Bangladesh, geology of Bangladesh. To understand the general trends in geo-morphological formations.
	CO3 – PO3	2	Ability to understand and evaluate the general trends in geo-morphological formations and geology of Bangladesh. To synthesize the general trends in geo-morphological formations and its importance in riverine areas of Bangladesh.

TEACHING AND LEARNING STRATEGY

	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio	 42 --

	• Student – Centered Learning	--
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 9 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

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

	Class 27	Channel morphology	
Week 10			
	Class 28	Structural geology	
	Class 29	Erosional process	
	Class 30	Channel morphology	
Week 11			
	Class 31	Erosional process	
	Class 32	Erosional process	
	Class 33	Channel patterns and the river basin	
Week 12			
	Class 34	Erosional process	CT 3
	Class 35	Channel patterns and the river basin	
	Class 36	Channel patterns and the river basin	
Week 13			
	Class 37	Erosional process	
	Class 38	Geology and geomorphology of Bangladesh	
	Class 39	Geology and geomorphology of Bangladesh	
Week 14			
	Class 40	Channel patterns and the river basin	
	Class 41	Channel patterns and the river basin	
	Class 42	Geology and geomorphology of Bangladesh	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO3	
	Class Participation	5%	CO2	
	Mid Term	15%	CO1, CO2	
Final Exam		60%	CO1	C1
			CO2	C2
			CO3	C1, C2, C4
Total Marks		100%		

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

REFERENCES 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

REFERENCE SITE

http://classroom.google.com/...../.........

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

PRE-REQUISITE

MATH 101 (Differential and Integral Calculus) , MATH 103 (Differential Equations and Matrix)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

In this course students will be given basic knowledge on 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 on the basic computations on 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 OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	To **analyze** the numerical problems using the different solution techniques.	PO – 2	C4	1		2	T, F
CO2	To **understand** the fundamental concepts in developing the algorithm for various computer codes.	PO – 1	C2	1, 3		1	T, M, F
CO3	To **solve** complex boundary value problems using the solution methods.	PO – 3	C3	1, 3		3	Asg/ CT, F

**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)

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, 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
CO1	To **analyze** the numerical problems using the different solution techniques.		3										
CO2	To **understand** the fundamental concepts in developing the algorithm for various computer codes.	3											
CO3	To **solve** complex boundary value problems using the solution methods.			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING			
	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO2	3	Knowledge of formulation, identification to analyze the numerical problems using the different solution techniques.
	CO2 – PO1	3	Knowledge of mathematics to understand the fundamental concepts in developing the algorithm for various computer codes. .
	CO3 – PO3	3	Develop to solve complex boundary value problems using the solution methods.

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 • Continuous Assessment • Final Examination	 2 3
	Total	80

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

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

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1	
	Class Participation	5%	CO2	
	Mid Term	15%	CO2, CO3	
Final Exam		60%	CO1	C2
			CO2	C2
			CO3	C3, C4
Total Marks		100%		

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

REFERENCES 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).

REFERENCE SITE

http://classroom.google.com/...../.........

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 be 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 and brick.
3. Identify the strength and deflection of different structural members.
4. 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 and brick.	PO – 1	C1	1		1, 3	R, T, Q
CO2	Be expert in **describing** the strength and deflection of different structural members.	PO – 1	C1	1, 2		5, 6	R, T, Q
CO3	Be able to **recognize** the appropriate relevant design codes through experiments.	PO – 4	C2	1, 3		5, 6	R, T, Pr, Q

**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>

(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)

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
CO1	Be able to **identify** the engineering properties of cement, aggregate and brick.	3											
CO2	Be expert in **describing** the strength and deflection of different structural members.	2											
CO3	Be able to **recognize** the appropriate relevant design codes through experiments.				3								

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to estimate the engineering

			properties of materials.
	CO2 – PO1	2	Knowledge of engineering fundamentals has to be applied to estimate deflection of different structural members. Slender column test and bending test of timber will help the students to understand the strength of a structural member.
	CO3 – PO4	3	Using the property of material obtained from laboratory test complex engineering problems can be investigated and appropriate design code and construction procedure can be selected.

TEACHING AND LEARNING STRATEGY	
	Teaching and Learning Activities
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning
	Self- Directed Learning • Non-face-to-face learning • Report writing • Preparation for examination
	Formal Assessment • Continuous Assessment • Quiz and Viva
	Total

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE	
	Intended Topics to be Covered
Week 1	
Class 1	Normal consistency and initial setting time of cement with ‘Vicat’s Apparatus’
Week 2	
Class 2	Sieve Analysis of fine and coarse aggregate
Week 3	
Class 3	Specific gravity and absorption capacity of coarse and fine aggregates. Unit weight and voids in aggregates.
Week 4	
Class 4	Direct compressive strength of cement mortar.
Week 5	
Class 5	Compressive strength of cylindrical concrete specimen.
Week 6	
Class 6	Determination of compressive strength and absorption capacity of bricks.
Week 7	

	Mid Quiz
Week 8	
Class 7	Tension tests of mild steel specimen
Week 9	
Class 8	Direct shear and impact tests of mild steel specimen
Week 10	
Class 9	Hardness test of metals
Week 11	
Class 10	Slender column test
Week 12	
Class 11	Helical spring test
Week 13	
Class 12	Static bending test
Week 14	
	Final Quiz , Viva / Presentation

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Class performance	10%	CO1	C1
Class assessment	10%	CO1	C1
Report Writing	20%	CO1, CO2, CO3	C1 , C2
Quiz	50%	CO1, CO2, CO3	C1 , C2
Viva	5%	CO1, CO3	C1
Presentation	5%	CO3	C2
Total Marks	100%		

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

REFERENCES 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.

REFERENCE SITE

http://classroom.google.com/...../.........

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

PRE-REQUISITE

EWCE-101 (Analytic Mechanics)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This is a basic fluid mechanics course. In this course students will be introduced to basic principles and analysis of fluid systems which will be helpful for the students on later stage of their study.

OBJECTIVE							
1. To understand the basic principles and analysis of both static and dynamic fluid systems. 2. To perform design calculations on engineering fluid systems.							
COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to **understand** the basic properties of fluids, and apply Newton's Law of Viscosity in solving practical problems	PO – 1	C2			1, 3	T, F
CO2	Able to **understand** the significance of basic principles of fluid statics and application of hydrostatic law in determining forces on surfaces and hydraulic structures	PO – 1	C2			1, 3, 4	T, M, F
CO3	Able to **understand** the basic principles of fluid kinematics and dynamics with specific emphasis on application of continuity equation, momentum equation etc.	PO – 1	C2	1		4, 5, 6	Asg/ CT, F
CO4	Able to **apply** the principles of Bernoulli's equation in measurement of discharge in pipes, and in other pipe flow problems	PO – 2	C3	3		5,6	F
CO5	Able to **apply** fundamental concepts in designing pipes and analysis of pipe networks	PO –3	C3	3		5, 6	F, Pr
**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)							
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, 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
CO1	Able to understand the basic properties of fluids, and apply Newton's Law of Viscosity in solving practical problems	3											
CO2	Able to understand the significance of basic principles of fluid statics and application of hydrostatic law in determining forces on surfaces and hydraulic structures	3											
CO3	Able to understand the basic principles of fluid kinematics and dynamics with specific emphasis on application of continuity equation, momentum equation etc.	3											
CO4	Able to apply the principles of Bernoulli's equation in measurement of discharge in pipes, and in other pipe flow problems		3										
CO5	Able to apply fundamental concepts in designing pipes and analysis of pipe networks			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING			
	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to understand the basic properties of fluids, and apply Newton's Law of Viscosity in solving practical problems
	CO2 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to understand the significance of basic principles of fluid statics and application of hydrostatic law in determining forces on surfaces and hydraulic structures.

	CO3 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to understand the basic principles of fluid kinematics and dynamics with specific emphasis on application of continuity equation, momentum equation etc.
	CO4 – PO2	3	Identification, formulation and analyzing to apply the principles of Bernoulli's equation in measurement of discharge in pipes, and in other pipe flow problems
	CO5 – PO3	3	Ability for designing pipes and analysis of pipe networks

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 final examination	 9 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120
TEACHING METHODOLOGY		
Lecture and Discussion, Problem Based Method		

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to Fluids and Fluid Mechanics	
	Class 2	Definition of a fluid, shear, strain rate and viscosity	
	Class 3	Different type of fluid flow	
Week 2			
	Class 4	Fluid properties: density, pressure etc	
	Class 5	Dynamic and Kinematic viscosity	
	Class 6	Surface Tension	CT 1
Week 3			
	Class 7	Fluid Statics: Pascal's law	
	Class 8	Variation of pressure, Manometers	
	Class 9	Forces on plane surface – concept and problem	CT 2
Week 4			
	Class 10	Forces on inclined surface	
	Class 11	Forces on curved surface – concept	MID
	Class 12	Forces on curved surface – problem	

Week 5			
	Class 13	Laminar and Turbulent Flows - Concept	
	Class 14	Laminar and Turbulent Flows - Problem	
	Class 15	Steady, Unsteady, Uniform, Non-uniform Flows	
Week 6			
	Class 16	1D, 2D and 3D Flows	
	Class 17	Streamlines, Path lines and Stream tubes - Concept	
	Class 18	Streamlines and Path lines - Problem	
Week 7			
	Class 19	Continuity Equation for 1D Steady Flow	
	Class 20	Stream Function, Potential Function and Flow net	
	Class 21	Various Types of Energy in Fluid Flow	
Week 8			
	Class 22	Bernoulli's Equation	
	Class 23	Kinetic Energy Coefficient – Concept and Problem	
	Class 24	Energy Equation for 1D Steady Flow	
Week 9			
	Class 25	Total Energy Line and Hydraulic Grade Line, Cavitations	
	Class 26	Head and Power - Pump	
	Class 27	Head and Power - Turbine	
Week 10			
	Class 28	Linear Momentum Equation	
	Class 29	Momentum Coefficient	
	Class 30	Force Exerted on Pressure Conduits	CT 3
Week 11			
	Class 31	Force Exerted on Stationary Vane	
	Class 32	Force Exerted on Moving Vane	
	Class 33	Reaction of a Jet	
Week 12			
	Class 34	Flow in pressure conduits	
	Class 35	General equation for fluid friction	
	Class 36	Darcy-Weisbach and Hagen-Poisevielle Equation	
Week 13			
	Class 37	Major and minor losses in pipe flow	
	Class 38	Pipes in series, expansions and contractions, loss coefficients	
	Class 39	Pipes in parallel, equivalent lengths	CT 4
Week 14			
	Class 40	Branching pipes	
	Class 41	Pipe networks, Hardy-Cross method	
	Class 42	Pipe networks, multiple pipe systems	
ASSESSMENT STRATEGY			

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO4	
	Class Participation	5%	CO2	
	Mid Term	15%	CO2, CO3	
Final Exam		60%	CO1	C1, C2
			CO2	C2
			CO3	C3, C4
			CO4	C2, C3, C4
Total Marks		100%		

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

REFERENCES BOOKS

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

REFERENCE SITE

http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 263	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 regarding hydrologic cycle, hydrological parameters and their inter relationships acquired from this course will be helpful for later semesters as well as in 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 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.	PO – 1	C1	1		1, 3	Asg/T, F
CO2	Able to **analyze** rainfall-runoff relationship, hydrographs and apply various statistical methods for hydrological analysis	PO – 2	C4	2	2	1, 4	T, M, F
CO3	Able to **compute** basic calculation on flood routing and other hydrologic data	PO-2	C3	2	2	1, 4	T,F

**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)

COURSE CONTENT

Hydrologic cycle, physics of air flow, cyclone, precipitation, Stream flow, infiltration and soil moisture, evaporation and evapo-transpiration, hydrologic data acquisition, rainfall-runoff relationships, Hydrographs 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
CO1	Able to **describe** the basic concepts of hydrology, various process, measurement and estimation of hydrological components: precipitation, evaporation, infiltration, stream flow etc.	3											
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 hydrologic data		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to describe the basic concepts of hydrology, various process, measurement and estimation of hydrological components: precipitation, evaporation, infiltration, stream flow etc.
	CO2 – PO2	3	In order to identify the problem specific solutions using first principles of mathematics, natural sciences and engineering knowledge of rainfall-runoff relationship, hydrographs and various statistical methods for hydrological analysis. is required.
	CO3 – PO2	3	To compute the basic calculation on flood routing, the concept of hydrological data needs to be applied.

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 final examination	 9 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction: Hydrological Cycle, Catchment Area	CT 1
	Class 2	Introduction: Water Budget Equation, Residence Time	
	Class 3	Weather System: Temperature and Pressure variation in the atmosphere,	
Week 2			

	Class 4	Weather System: Weather parameter estimation	
	Class 5	Weather System: Precipitable water in the air column	
	Class 6	Precipitation: Formation of precipitation, Forms of precipitation	
Week 3			
	Class 7	Precipitation: Measurement of precipitation, Computation of average rainfall	
	Class 8	Precipitation: Analysis of Rainfall Data.	
	Class 9	Precipitation: Presentation of Rainfall Data	
Week 4			
	Class 10	Evaporation: Evaporation process, Estimation of evaporation	
	Class 11	Evaporation: Transpiration and Evapo-transpiration,	
	Class 12	Evaporation: Estimation of Potential Evapo-transpiration	
Week 5			Mid Term Exam
	Class 13	Infiltration: Infiltration and Infiltration Capacity, Horton's equation for Infiltration Capacity	
	Class 14	Infiltration: Horton's equation for Infiltration Capacity, Infiltration Index	
	Class 15	Infiltration: Infiltration Index	
Week 6			
	Class 16	Hydrograph: Storm Hydrograph and its component,	
	Class 17	Hydrograph: Factors affecting flood/storm hydrograph	
	Class 18	Hydrograph: Base flow separation technique for measuring Direct Runoff Hydrograph (DRH)	
Week 7			
	Class 19	Hydrograph: Effective Rainfall, Effective Rainfall Hyetograph (ERH)	
	Class 20	Hydrograph: Relationship between ERH and DRH	
	Class 21	Unit Hydrograph: Unit Hydrograph and its characteristics	
Week 8			
	Class 22	Unit Hydrograph: Time invariance and Linear Response	CT 2
	Class 23	Unit Hydrograph: Derivation of Unit Hydrograph	
	Class 24	Unit Hydrograph: Synthetic Unit Hydrograph	
Week 9			
	Class 25	Runoff: Components of runoff, Stream characteristics,	
	Class 26	Runoff: Yield of a river, Rainfall & Runoff correlation	
	Class 27	Runoff: Flow-Duration curve, Drought: Occurrence,	

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

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO2.CO3	
	Class Participation	5%	CO1, CO4	
	Mid Term	15%	CO2	
Final Exam		60%	CO1	C1
			CO2	C4
			CO3	C3
Total Marks		100%		

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

REFERENCES BOOKS

1. Engineering Hydrology – K Subramanya. 2. Applied Hydrology (Int'l Edn 1988)-Chow, Maidment and Mays, McGraw-Hill International Editions. 3. Groundwater Hydrology - David Keith Todd, Larry W. Mays, 3rd ed. Wiley Schaum's Outline of Introductory Surveying - Roy Wirshing and James Wirshing.
REFERENCE SITE
http://classroom.google.com/...../.........

COURSE INFORMATION		
Course Code: EWCE 300 Course Title: Students' Internship Program (SIP)	Credit hours Contact hours	: 1.0 : 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.		

COURSE OUTCOMES AND SKILL MAPPING

No.	COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Ability to **gain** practical professional experience in civil/ environmental/ water resources engineering	√											
CO2	Ability to **work** effectively as an individual and also as a member of a team during industrial attachment									√			

CO3	Ability to **develop** an appreciation of the breadth of civil/ environmental/ water resources engineering which helps to gain life-long learning capability												√
CO4	Ability to **perform** verbal presentation on the gained knowledge										√		

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (4 hours/week x 2 weeks)	40
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, Co-operative and Collaborative Method, Problem Based Learning (PBL)

TEACHING SCHEDULE

Weeks	Topic	Assessments
1	Visit of one industry	Presentation, Report, VIVA
2	Visit of another industry	
3	Preparing report based on their gather knowledge during industrial training Preparing presentation for shearing gathered knowledge Preparation for viva	

ASSESSMENT STRATEGY

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

REFERENCE BOOKS

N/A

REFERENCE SITE

N/A

COURSE INFORMATION	
Course Code: EWCE 311	Credit Hour: 4.0
Course Title: Structural Analysis and Design I	Contact Hour: 4.0

PRE-REQUISITE

EWCE 101 (Analytic 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 also 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, truss subjected to dead load, lateral load and vertical load.
3. To analyze structures for moving load.
4. To construct influence line diagram for beam, frame and truss.
5. To draw internal force diagrams and to calculate the displacements.

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to **analyze** statically determinate and indeterminate structures.	PO – 2	C4	1		5,6	CT,M, F
CO2	Ability to **determine** lateral load on structure at different area in Bangladesh.	PO – 2	C4, C5	1		5,6	Pr/M, F
CO3	Able to **develop** knowledge on various types of structures and their behavior.	PO –1, 2	C2, C5	1, 3		3	Asg/ CT, F
CO4	Ability to **determine** axial load on a column from different stories.	PO – 2	C4	1		4,5 ,6	Asg/ F
CO5	Able to **analyze** the effect of moving loads on statically determinate structures.	PO – 2	C4	1		2,3	CT/F

**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)

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 multi-storied 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, Castigliano's theorem), 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
CO1	Be able to **analyze** statically determinate and indeterminate problems.		3										
CO2	Be able to **determine** lateral loads on structures.		3										
CO3	Be able to **develop** knowledge on various types of structures and their behavior	2	3										
CO4	Be able to determine axial load on column		3										
CO5	Be able to **analyze** the effect of moving loads on statically determinate structures.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO2	3	Knowledge of approximate method and cantilever method will be applied to solve different indeterminate structures frame and truss. Knowledge of mechanics will be applied to solve determinate structures.
	CO2 – PO2	3	Using BNBC 1993 and 2014 code provision earthquake load and wind load will be calculated.
	CO3 – PO1	2	Students will be able to classify structures and find out behavior using mathematics, natural science and engineering fundamentals.
	CO3 – PO2	3	Ability to formulate engineering problems and to solve those complex engineering problems using structural knowledge.

	CO4 – PO2	3	Using approximate method or cantilever method students will be able to calculate axial force and moment in beam and column in different storey of structures.
	CO5 – PO2	3	Maximum moment, reaction, shear force will be calculated at a particular location of a beam and frame under moving concentric load and uniformly distributed load. Students will be able to calculate maximum bar force of a truss under moving load.

TEACHING AND LEARNING STRATEGY		
	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 56 -- --
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 12 24 63
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	160

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Stability and determinacy of structure	
	Class 2	Stability and determinacy of structure	
	Class 3	Earthquake load calculation as per BNBC-1993	
	Class 4	Earthquake load calculation as per BNBC-1993	
Week 2			
	Class 5	Analysis of statically determinant truss	
	Class 6	Analysis of statically determinant truss	
	Class 7	Earthquake load calculation as per BNBC-2014	
	Class 8	Earthquake load calculation as per BNBC-2014	

Week 3			
	Class 9	Analysis of statically determinant arches	
	Class 10	Analysis of statically determinant arches	
	Class 11	Wind load calculation as per BNBC-1993	
	Class 12	Wind load calculation as per BNBC-1993	
Week 4			
	Class 13	Analysis of statically determinant arches	CT-1
	Class 14	Analysis of statically determinant arches	
	Class 15	Wind load calculation as per BNBC-2014	
	Class 16	Wind load calculation as per BNBC-2014	
Week 5			
	Class 17	Influence line of beams	
	Class 18	Influence line of beams	
	Class 19	Approximate analysis of statically indeterminate truss	
	Class 20	Approximate analysis of statically indeterminate truss	
Week 6			
	Class 21	Influence line of beams	
	Class 22	Influence line of beams	
	Class 23	Approximate analysis of statically indeterminate portal frame subjected to vertical load.	
	Class 24	Approximate analysis of statically indeterminate portal frame subjected to vertical load.	Mid Term Exam
Week 7			
	Class 25	Influence line of truss	
	Class 26	Influence line of truss	
	Class 27	Approximate analysis of statically indeterminate portal frame subjected to lateral load using portal method	
	Class 28	Approximate analysis of statically indeterminate portal frame subjected to lateral load using portal method	
Week 8			
	Class 29	Influence line of truss	
	Class 30	Influence line of truss	
	Class 31	Approximate analysis of statically indeterminate portal frame using cantilever method	CT 2

	Class 32	Approximate analysis of statically indeterminate portal frame using cantilever method	
Week 9			
	Class 33	Moving load on beams	
	Class 34	Moving load on beams	
	Class 35	Approximate analysis of tower truss	
	Class 36	Approximate analysis of tower truss	
Week 10			CT 3
	Class 37	Moving load on beams	
	Class 38	Moving load on beams	
	Class 39	Approximate analysis of tower truss	
	Class 40	Approximate analysis of tower truss	
Week 11			
	Class 41	Moving load on frame	
	Class 42	Moving load on frame	
	Class 43	Principle of work and energy. Principle of virtual work	
	Class 44	Analysis and deflection calculation of truss using method of virtual work	
Week 12			CT 4
	Class 45	Moving load on frame	
	Class 46	Moving load on frame	
	Class 47	Introduction to Castigliano's theorem	
	Class 48	Analysis and deflection calculation of truss using Castigliano's theorem	
Week 13			
	Class 49	Analysis of suspension bridge	
	Class 50	Analysis of suspension bridge	
	Class 51	Analysis and deflection calculation of beam using method of virtual work	
	Class 52	Analysis and deflection calculation of frame using method of virtual work	
Week 14			
	Class 53	Analysis of suspension bridge	
	Class 54	Analysis of suspension bridge	
	Class 55	Analysis and deflection calculation of beam using Castigliano's theorem	
	Class 56	Analysis and deflection calculation of frame using Castigliano's theorem	
	ASSESSMENT STRATEGY		

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment	Class Test/ Assignment/Presentati	20%	CO1, CO2	

(40%)	on (1-4)			
	Class Participation	5%	CO1 , CO3	
	Mid Term	15%	CO1 ,CO2	
Final Exam		60%	CO1	C4
			CO2	C4
			CO3	C2, C5
			CO4	C4
			CO5	C4
Total Marks		100%		

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

REFERENCES 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)

REFERENCE SITE

http://classroom.google.com/...../.........

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

PRE-REQUISITE

EWCE-261 (Fluid Mechanics)

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 OUTCOMES & GENERIC SKILLS

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

CO 1	Be able to **estimate** the fresh water demand and **assess** the requirements for preferred water supply system in urban as well as rural areas	PO – 1	C2	1		1, 3	T, F
CO 2	Be expert in **identifying** problem specific solutions to provide fresh water supply options including groundwater well and RWH in urban as well extremely water shortage areas	PO – 1	C2	1, 3		1, 4	T, M, F
CO 3	Be able to **apply** engineering perception to construct complex water supply distribution networks in terms of economic, public health, Environment and sustainability	PO – 2, 7	C3	1, 3		4, 7	Asg/ CT, F
CO 4	Be proficient 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	PO – 2, 3	C4	1, 3		1, 5	F, Pr

**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)

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
CO1	Be able to **estimate** the fresh water demand and **assess** the requirements for preferred water supply system in urban as well as rural areas	3											
CO2	Be expert in **identifying** problem specific solutions to provide fresh water supply	3											

	options including groundwater well and RWH in urban as well extremely water shortage areas												
CO3	Be able to **apply** engineering perception to construct complex water supply distribution networks in terms of economic, public health, Environment and sustainability		3					2					
CO4	Be proficient 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	2									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to estimate the fresh water demand and assess the requirements for preferred water supply system in urban as well as rural areas.
	CO2 – PO1	3	In order to identify the problem specific solutions for providing fresh water supply options in urban as well in the extremely water shortage areas, the knowledge of mathematics, natural science and engineering fundamentals is required.
	CO3 – PO3	3	To outline the water supply distribution networks within the constraints of economic, public health, environment and safety, the ability to design the system along with its component is required.
	CO3 – PO7	2	Ability to understand and evaluate the sustainability and impact of constructing community water supply distribution networks are required from societal and environmental context.
	CO4 – PO2	3	Ability for problem formulation and analysis using mathematics, natural science and engineering fundamentals are

			required for capabilities are required to design and construct efficient and cost-effective water treatment plants for the community
	CO4 – PO3	2	Ability to design and construct efficient and cost-effective water treatment plant is required, with appropriate consideration for public health and safety, societal and environmental concerns.

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 final examination	 9 18 46
Formal Assessment • Continuous Assessment • Final Examination	 2 3
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Water supply, health and sanitation, history and development of water supply Engineering	
	Class 2	Importance of water supply Engineering, Elements of public water supply, Sources of water supply	
	Class 3	Environment and Environmental impacts on Human Life, Water supply, health and sanitation, Ecology and Environment, Role of Environmental Engineer	
Week 2			
	Class 4	Population Estimation and water demand forecasting	CT 1
	Class 5	Fire demand calculation and fire hydrant design	
	Class 6	Suitability of sources with regards to quantity and quality, Choice of sources for water supply	Mid Term Exam
Week 3			
	Class 7	Aquifer properties, basic definitions, types of aquifers, confined and unconfined aquifers	
	Class 8	Groundwater hydraulics, porosity, seepage,	

		infiltration, permeability	
	Class 9	Surface water collection units, Water treatment units,	
Week 4			
	Class 10	Darcy's law, discharge equation for confined aquifers with example problems	
	Class 11	Discharge equation for unconfined aquifers with example problems	
	Class 12	Water distribution system, Distribution methods	
Week 5			
	Class 13	Withdrawal of excessive groundwater, consequences of groundwater abstraction	
	Class 14	Basic concept of water well design, sieve analysis, bore hole construction	
	Class 15	Water transmission line design	
Week 6			
	Class 16	Gravel pack design	
	Class 17	Well drilling and construction	
	Class 18	Single pipe design, Serial and branched networks	
Week 7			
	Class 19	Water well maintenance	
	Class 20	Problems of groundwater in Bangladesh	
	Class 21	Looped networks, Hardy Cross Method	
Week 8			
	Class 22	Pump and pumping machineries, Requirement of water pump	
	Class 23	Water impurities Water quality requirements	CT 2
	Class 24	Water quality standards	
Week 9			
	Class 25	Plain sedimentation	
	Class 26	Coagulation, Flocculation	
	Class 27	Pump performance curve	
Week 10			
	Class 28	Filtration	
	Class 29	Disinfection	
	Class 30	Surface water intake design	
Week 11			
	Class 31	Iron and Manganese removal	
	Class 32	Arsenic removal	
	Class 33	Water supply in coastal saline affected areas	
Week 12			
	Class 34	Alternative and Low cost water supply options	CT 3
	Class 35	Taste and odor control	
	Class 36	Water softening	
Week 13			
	Class 37	Auditing of water, Leak detection in water mains, Using water efficient appliances and fixture	
	Class 38	Membrane technologies – reverse osmosis	

	Class 39	Water safety through water safety plans	
Week 14			
	Class 40	Water demand management, Water charging/ tariff, Water conservation	
	Class 41	Developing a WSP	
	Class 42	Review of water treatment options with examples	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO4	
	Class Participation	5%	CO2	
	Mid Term	15%	CO2, CO3	
Final Exam		60%	CO1	C1, C2
			CO2	C2
			CO3	C3, C4
			CO4	C2, C3, C4
Total Marks		100%		

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

REFERENCES 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. Water Safety Plan (WSP) – A Risk Based Approach for Water Safety, 1st ed., ITN-BUET.

REFERENCE SITE

http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 332	Credit Hour: 1.5
Course Title: Environmental Engineering Sessional-I	Contact Hour: 3.0
PRE-REQUISITE	
EWCE105, CHEM-102, CE-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 are conducted according to the standard code.

COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to **use** sophisticated instruments to analyse water quality parameters with their standard test protocol in terms of Engineering practice.	PO – 5	C3	1		6	Viva, Quiz
CO2	Ability to **conduct** experiments to analyse 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.	PO – 4	C4	2		4	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)

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
CO1	Ability to **use** sophisticated instruments to analyze water quality parameters with their standard test protocol in terms of Engineering practice.					3							
CO2	Ability to **conduct** experiments to analyze the water quality				4								

	parameters against their standards and also to interpret data in order to ensure safe water supply requirements to protect public health and Environment.												

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO5	3	Ability to **use** sophisticated instruments to analyze water quality parameters with their standard test protocol in terms of Engineering practice.
	CO2 – PO4	3	Ability to **conduct** experiments to analyse 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.

TEACHING AND LEARNING STRATEGY

	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture (1 hours/week x 10 weeks) • Experiment (1 hr/week X10 weeks) • Data analysis and calculation (0.75 hr/week X 10 weeks)	10 10 7.5
	Guided Learning • Report Writing (2 hours/week x 10 weeks)	20
	Independent Learning • Preparation for tests and examination	07
	Assessment • Quiz • Viva • 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

		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction, units of measurements, sampling procedure	
		Determination of pH of water	
		Determination Color of water	Viva, Class

Week 2			Assessment, Report, Quiz -1	
	Class 2	Determination Turbidity of water		
		Determination TS, TDS, TSS of water		
Week 3				
	Class 3	Determination of CO_2		
		Determination of Chloride of Water		
Week 4				
	Class 4	Determination of Alkalinity of water		
		Determination of Hardness of water		
Week 5				
	Class 5	**Quiz --- 1**		
Week 6			Viva, Class Assessment, Report, Quiz -2	
	Class 6	Determination of Biochemical Oxygen Demand (BOD_5)		
		Determination of Chemical Oxygen Demand (COD)		
Week 7				
	Class 7	Determination of Total Iron of Water		
		Determination of Arsenic contamination of water		
Week 8				
	Class 8	Alum Coagulation		
		Determination of Total and Fecal Coliform of water		
Week 9				
	Class 9	Break Point Chlorination		
Week 10				
	Class 10	Noise survey, data collection and laboratory analysis		
Week 11				
	Class 11	Air quality survey, data collection and laboratory analysis		
Week 12				
	Class 12	Review Lectures and Viva/Assessment		
Week 13				
	Class 13	Quiz - 2		
Week 14				
	Class 14	No class		

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Continuous Assessment (Class Assessment, Report)	20%	CO1, CO2	C3, C4
	Viva	10%	CO1, CO2	C3, C4
	Quiz	70%		
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affectiv Domain)
REFERENCES BOOKS
1. A Textbook of Water Supply Engineering by – M.A. Aziz 2. Water Supply and Sanitation by – Ahmed and Rahman 3. Laboratory Manual
REFERENCE SITE
http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 333	Credit Hour: 4.0
Course Title: Waste Water Engineering and Sanitation	Contact Hour: 4.0
PRE-REQUISITE	
Chem 101, EWCE-200 (Details of Construction and Quantity Surveying), EWCE-201 (Construction Materials), 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 OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO 1	Able 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	PO – 1	C2	1		1, 3	T, F

	areas						
CO 2	Able 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	PO – 7	C2	1, 3		1, 4	T, M, F
CO 3	Able to **apply** Engineering perception to construct sewerage networks and building plumbing in terms of economic, public health, Environment and sustainability	PO – 7	C3	1, 3		4, 7	Asg/ CT, F
CO 4	Able 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	PO – 3	C4	1, 3		1, 5	F, Pr

**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)

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
CO1	Be able 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	3											
CO2	Be able 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							2					
CO3	Be able to **apply** Engineering perception to construct sewerage networks and building plumbing in terms of economic, public health, Environment and sustainability							2					
CO4	Be able 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			2									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING			
	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to 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
	CO2 – PO7	2	Ability to understand and evaluate the sustainability and impact of starting construction of any development projects so that adverse environmental impacts could be minimized timely and effectively

	CO3 – PO7	2	Ability to understand and evaluate the sustainability and impact of constructing sewerage networks and building plumbing in terms of economic, public health, Environment and sustainability
	CO4 – PO3	2	Ability to design and construct efficient and cost-effective ETP and STP with appropriate consideration for public health and safety
TEACHING AND LEARNING STRATEGY			
	Teaching and Learning Activities	Engagement (Hours)	
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 56 -- 	
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 20 30 46	
	Formal Assessment • Continuous Assessment • Final Examination	 5 3	
	Total	160	
TEACHING METHODOLOGY			
Lecture and Discussion, Problem Based Method			
COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to Wastewater Engineering	
	Class 2	Estimation of wastewater	
	Class 3	Water supply, sanitation and health I	
	Class 4	Water supply, sanitation and health II	
Week 2			
	Class 5	Wastewater collection systems I	
	Class 6	Wastewater collection systems II	
	Class 7	Sanitation for low-income communities I	
	Class 8	Sanitation for low-income communities II	CT 1
Week 3			
	Class 9	Wastewater collection systems III	
	Class 10	Wastewater collection systems IV	
	Class 11	Sanitation for low-income communities III	
	Class 12	Sanitation for low-income communities IV	
Week 4			
	Class 13	Hydraulics of sewer	
	Class 14	Design, construction and maintenance of sanitary sewer I	

	Class 15	Sanitation for low-income communities V	
	Class 16	Sanitation for low-income communities VI	
Week 5			
	Class 17	Design, construction and maintenance of sanitary sewer II	
	Class 18	Design, construction and maintenance of sanitary sewer III	
	Class 19	Sanitation for low-income communities VII	
	Class 20	Sanitation for low-income communities VIII	
Week 6			
	Class 21	Design, construction and maintenance of storm drainage system IV	Mid Term Exam
	Class 22	Design, construction and maintenance of storm drainage system V	
	Class 23	Design and construction of septic tanks I	
	Class 24	Design and construction of septic tanks II	
Week 7			
	Class 25	Sewer appurtenances I	
	Class 26	Sewer appurtenances II	
	Class 27	Design and construction of soak wells I	
	Class 28	Design and construction of soak wells II	
Week 8			
	Class 29	Microbiology of sewage and waste water I	
	Class 30	Microbiology of sewage and waste water II	
	Class 31	Design and construction of subsurface drain fields I	
	Class 32	Design and construction of subsurface drain fields II	
Week 9			
	Class 33	Wastewater characteristics I	CT 2
	Class 34	Wastewater characteristics II	
	Class 35	Plumbing system for building I	
	Class 36	Plumbing system for building II	
Week 10			
	Class 37	Primary treatment methods I	
	Class 38	Primary treatment methods II	
	Class 39	Sustainability of water services I	
	Class 40	Sustainability of water services II	
Week 11			
	Class 41	Secondary treatment methods I	
	Class 42	Secondary treatment methods II	
	Class 43	Sustainability of sanitation services I	
	Class 44	Sustainability of sanitation services II	
Week 12			
	Class 45	Wastewater effluent disposal I	CT 3
	Class 46	Wastewater effluent disposal II	
	Class 47	Participatory development approach in water and sanitation sector I	
	Class 48	Participatory development approach in water	

		and sanitation sector II	
Week 13			
	Class 49	Treatment and disposal of industrial effluents I	
	Class 50	Treatment and disposal of industrial effluents II	
	Class 51	Community management of water services I	
	Class 52	Community management of water services II	
Week 14			
	Class 53	Sludge treatment and disposal I	
	Class 54	Sludge treatment and disposal II	
	Class 55	Community management of sanitation services I	
	Class 56	Community management of sanitation services II	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO4	
	Class Participation	5%	CO2	
	Mid Term	15%	CO2, CO3	
Final Exam		60%	CO1	C1, C2
			CO2	C2
			CO3	C3, C4
			CO4	C2, C3, C4
Total Marks		100%		

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

REFERENCES BOOKS

1. Water Supply and Sanitation- Feroz Ahmed and Mujibur Rahman.
2. Environmental Engineering – Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, McGraw Hill International Edition.
3. Environmental Sanitation, Wastewater Treatment and Disposal – Tanveer Ferdous Saeed, Abdullah Al-Muyeed, Tanvir Ahmed.
4. Introduction to Environmental Engineering – Gilbert M. Masters and Wendell P. Ela, 3rd ed., Prentice-Hall Inc.Wastewater Engineering- Metcalf and Eddy.
5. Water Supply and Sewerage- Terence J. McGhee.
6. Wastewater Engineering- Metcalf and Eddy.
7. Plumbing Practices – Syed Azizul Haq, Peng
8. Plumbing Installation and Design – L. V. Ripka, 4th ed.

REFERENCE SITE

http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 341	Credit Hour: 3.0
Course Title: Principles of Soil Mechanics	Contact Hour: 3.0
PRE-REQUISITE	

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

This is the introductory course on geotechnical engineering where students will be presented with basic knowledge on types and identification of soil, soil properties and theories on soil mechanics. Student will be further exposed to soil mechanics software which will be useful in later semesters and also in professional life.

OBJECTIVE

1. To gain insight on the basics of soil types and its different ground formations.
2. To understand the basic theories of soil mechanics and its practical applicability.

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO 1	Be able to **comprehend** the physical and index properties of soil and their use in engineering classification	PO – 1	C2	1		1, 3	T, F
CO 2	Be able to **estimate** the distribution of stresses within the soil mass due to overburden, pore water and external loading	PO – 2	C2	1		1, 3	T, M, F
CO 3	Be able to **analyze** the failure of soil mass considering stress-strain-strength characteristics, compressibility of soil and the effect of overburden and surface loading on earth retaining and bearing structures	PO – 3	C4	1, 3		1, 4	Asg/ CT, F
CO 4	Be able to **evaluate** the performance of soil due to consolidation processes.	PO – 3	C5	1, 3		1, 6	F

**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)

COURSE CONTENT

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

SKILL MAPPING (CO – PO MAPPING)

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

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to comprehend the physical and index properties of soil and their use in engineering classification.
	CO2 – PO2	3	In order to identify the problem specific solutions for estimating the distribution of stresses within the soil mass due to overburden, pore water and external loading.
	CO3 – PO3	2	To analyze the failure of soil mass considering stress-strain-strength characteristics, compressibility of soil and the effect of overburden and surface loading on earth retaining and bearing structures to design the foundation of infrastructure.
	CO4 – PO3	2	To evaluate the performance of soil due to consolidation processes for designing solution for complex engineering problem like foundation settlement.

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 final examination	 9 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction	
	Class 2	Scope of Geotechnical Engineering: Soil Mechanics and foundation engineering	
	Class 3	Formation, type and identification of soils	
Week 2			
	Class 4	Formation, type and identification of soils (cont.)	CT 1
	Class 5	Soil composition	
	Class 6	Soil structure and fabric	Mid Term Exam
Week 3			
	Class 7	Soil particle size	
	Class 8	Specific gravity	
	Class 9	Particle size distribution curve	
Week 4			
	Class 10	Weight-Volume Relationship	
	Class 11	Weight-Volume Relationship (cont.)	
	Class 12	Weight-Volume Relationship (cont.)	
Week 5			
	Class 13	Index properties of soils	
	Class 14	Engineering classification of soils	
	Class 15	Engineering classification of soils (cont.)	
Week 6			
	Class 16	Soil compaction	
	Class 17	Soil compaction (cont.)	
	Class 18	Principles of total and effective stresses	
Week 7			
	Class 19	Principles of total and effective stresses (cont.)	
	Class 20	Principles of total and effective stresses (cont.)	
	Class 21	Stress distribution within the soil mass due to external	

		loadings	
Week 8			
	Class 22	Seepage	
	Class 23	Seepage (cont.)	CT 2
	Class 24	Seepage (cont.)	
Week 9			
	Class 25	Permeability	
	Class 26	Permeability (cont.)	
	Class 27	Permeability (cont.)	
Week 10			
	Class 28	Stress-strain-strength characteristics of soils	
	Class 29	Stress-strain-strength characteristics of soils (cont.)	
	Class 30	Stress-strain-strength characteristics of soils (cont.)	
Week 11			
	Class 31	Shear strength of soil	
	Class 32	Shear strength of soil (cont.)	
	Class 33	Shear strength of soil (cont.)	
Week 12			
	Class 34	Lateral earth pressure	
	Class 35	Lateral earth pressure (cont.)	CT 3
	Class 36	Lateral earth pressure (cont.)	
Week 13			
	Class 37	Compressibility of soils	
	Class 38	Compressibility of soils (cont.)	
	Class 39	Compressibility of soils (cont.)	
Week 14			
	Class 40	Soil settlement	
	Class 41	Soil settlement (cont.)	
	Class 42	Review and problem solving	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO4	
	Class Participation	5%	CO2	
	Mid Term	15%	CO1, CO2	
Final Exam		60%	CO1	C1
			CO2	C2
			CO3	C3, C4
			CO4	C5
Total Marks		100%		

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

REFERENCES 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.

REFERENCE SITE
http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 342	Credit Hour: 1.5
Course Title: Soil Mechanics Sessional	Contact Hour: 3.0
PRE-REQUISITE	
EWCE-101(Analytical Mechanics), EWCE-200 (Details of Construction and Quantity Surveying), EWCE-201 (Construction Materials), EWCE-203 (Geology and Geomorphology), EWCE-211 (Mechanics Solid-I), EWCE-263 (Hydrology) , EWCE-261 (Fluid Mechanics)	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
In this sessional course students will be given the basic knowledge on different types of soil investigation equipment and techniques for both laboratory and field tests of soil 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 become skilled at the design and construction of footings, rafts and piles in sand and clay type soil. 3. To devise the theories for stability of slopes	

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **determine** various properties of soil like index properties, compressibility and pressure exists in soil, strain-stress characteristics using standard equipment	PO – 1	C5	1		1, 3	R, M, V
CO2	Be able to **analyse** the performance of soil under compaction, consolidation, seepage etc	PO – 2	C4	1		1, 4	R, F, V

**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, M – Mid Quiz, R – Report, F – Final Quiz, Asg – Assignment V-Viva.)

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, test of

geotextiles.
SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **determine** various properties of soil like index properties, compressibility and pressure exists in soil, strain-stress characteristics using standard equipment	3											
CO2	Be able to **analyze** the performance of soil under compaction, consolidation, seepage etc.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to **determine** various properties of soil like index properties, compressibility and pressure exists in soil, strain-stress characteristics using standard equipment
	CO2 – PO2	3	Be able to **analyse** the performance of soil under compaction, consolidation, seepage etc. by using the principles of mathematics, the natural sciences and the engineering sciences

TEACHING AND LEARNING STRATEGY

	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 12 24 --
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 12 12 14
	Formal Assessment • Continuous Assessment	 24

	• Final Examination	1.5
	Total	99.5

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction	
Week 2			
	Class 2	Field identification tests of soils	
Week 3			
	Class 3	Grain size analysis of soil by sieve and hydrometer	
Week 4			
	Class 4	Specific gravity test of soil	
Week 5			
	Class 5	Atterberg limits test	
Week 6			
	Class 6	Relative density test	
Week 7			
	Class 7	Mid Quiz	
Week 8			
	Class 8	Constant head and falling head permeability tests	
Week 9			
	Class 9	Unconfined compression test	
Week 10			
	Class 10	Compaction test (standard and modified)	
Week 11			
	Class 11	Direct shear tests	
Week 12			
	Class 12	Consolidation test (one dimensional)	
Week 13			
	Class 13	Triaxial compression test (UU, CU and CD)	
Week 14			
	Class 14	Final Quiz	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1	
	Class Participation	5%	CO2	
	Mid Term	15%	CO1, CO2	
Final Exam		60%	CO1	C5
			CO2	C4
Total Marks		100%		

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

Affective Domain)
REFERENCES BOOKS
1. Geotechnical Engineering Laboratory Handout: MIST 2. Soil Mechanics Laboratory Manual – B.M. Das 3. ASTM Standards for Geotechnical Engineering
REFERENCE SITE
http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 343	Credit Hour: 3.0
Course Title: Geotechnical and Foundation Engineering	Contact Hour: 3.0
PRE-REQUISITE	
EWCE 341(Principles of Soil Mechanics), EWCE 342(Soil Mechanics Sessional)	
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 OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **explore** the subsoil condition of a site and to determine the properties of foundation soil in order to design and construct proper types of foundation of any civil engineering structures.	PO – 1	C1	1		1,3	T, F
CO2	Be expert in **evaluating** the bearing capacity and settlement for the purpose of designing footing and raft foundations for a structure on various subsoil and loading conditions.	PO – 2	C5	3		3	T, M, F

CO3	Be 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**.**	PO – 2	C5	3		3	Asg/ T, F
CO4	Be proficient to **analyze** the performance of existing foundation and **construct** new footing, raft and pile foundation in various subsoil conditions.	PO – 2, 3	C4	1,3		4, 5,6	T,F
CO5	Be expert to **analyze** the stability of any soil slopes in order to determining proper and stable slopes on various subsoil and groundwater conditions.	PO – 2	C4	1,3		4,6	Asg, F

**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)

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 pressure, 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
CO1	Be able to explore the subsoil condition of a site and to determine the properties of foundation soil in order to design and construct proper types of foundation of any civil engineering structures.	3											
CO2	Be expert in evaluating 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	Be able to evaluate the bearing capacity and settlement for the purpose of designing single and group		3										

	pile foundation for a structure in various types of subsoil and loading conditions**.**												
CO4	Be proficient to analyze the performance of existing foundation and construct new footing, raft and pile foundation in various subsoil conditions.		3	2									
CO5	Be expert to analyze the stability of any soil slopes in order to determining proper and stable slopes on various subsoil and groundwater conditions.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to explore the subsoil condition of a site and to determine the properties of foundation soil in order to design and construct proper types of foundation of any civil engineering structures.
	CO2 – PO2	3	Ability 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.
	CO3 – PO2	3	Ability 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**.**
	CO4 – PO2	3	Ability to analyze the performance of existing foundation in various subsoil conditions.
	CO4 – PO3	2	Ability to design new footing, raft and pile foundation in various subsoil conditions.

	CO5 – PO2	3	Ability to analyze the stability of any soil slopes in order to determining proper and stable slopes on various subsoil and groundwater conditions.

TEACHING AND LEARNING STRATEGY		
	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 42 15 --
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 12 18 28
	Formal Assessment • Continuous Assessment(Pop Quiz/Class Test/Mid Term Exam) • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY
Lecture, Tutorial, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Scope and aspects of foundation engineering	
	Class 2	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.	
	Class 3	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.	
Week 2			
	Class 4	Types of boring: Auger boring, Hollow stem auger boring, Wash boring, Percussion boring, ODEX drilling	CT 1

	Class 5	Types of boring: Auger boring, Hollow stem auger boring, Wash boring, Percussion boring, ODEX drilling	
	Class 6	Bearing capacity of strip footing on cohesionless soil, Effect of footing shapes on bearing capacity,	Mid Term Exam
Week 3			
	Class 7	Determination of ground water table, Soil sampling techniques.	
	Class 8	Penetration tests, Standard penetration test and SPT N-values, Corrections for SPT N-values, SPT and soil strength parameters.	
	Class 9	Design charts for the design of footing on cohesionless soil.	
Week 4			
	Class 10	Types of soil samplers, Types of soil samples and their usages, Sample disturbance and its measurement, Rock quality designation	
	Class 11	Dynamic cone penetration test, Dutch cone penetration (CPT), Cone and sleeve resistance.	
	Class 12	Bearing capacity of footing on clay, Skempton's equation.	
Week 5			
	Class 13	CPT friction ratio and its relationship with soil types, Use of piezocone in determining porewater pressure and water table, CPT-SPT relations.	
	Class 14	Geophysical methods of subsoil investigation, Field vane shear test, Subsoil investigation report.	
	Class 15	Effect of load eccentricity on bearing capacity, Meyerhof concept of equivalent footing width.	
Week 6			
	Class 16	Types of deep foundation, Classification and use of pile foundation.	
	Class 17	Driven and bored piles, Friction and bearing piles, Analysis of skin friction and end bearing for driven piles in sand.	
	Class 18	Bearing capacity of raft foundation, Factor of safety in bearing capacity.	
Week 7			
	Class 19	Critical depth concept for piles in cohesionless soil, Estimation of skin friction and end bearing using critical depth concept.	

	Class 20	Computation of skin friction of driven piles in clay, α-method.	
	Class 21	Construction problems of footing and raft foundation.	
Week 8			
	Class 22	Computation of skin friction of driven piles in clay, β-method, λ-method.	
	Class 23	End bearing for piles in clay soil, Bearing capacity of group piles in sand and clay, Efficiency of pile group.	CT 2
	Class 24	Computation of settlement of footing, Elastic settlement, immediate settlement and consolidation settlement.	
Week 9			
	Class 25	Effect of load eccentricity on group piles, Estimation of bearing capacity from SPT-value for piles in sand, clay and silty soil.	
	Class 26	Pile driving formula, Uplift capacity of individual pile and group.	
	Class 27	Construction problems of driven piles.	
Week 10			
	Class 28	Negative skin friction and remedial measures. Bearing capacity of bored piles,	
	Class 29	Pile load test and interpretation of load test data.	
	Class 30	Construction problems of bored piles, Methods of advancing holes.	
Week 11			
	Class 31	Introduction to stability of slopes, Analysis of infinite slopes of cohesionless, cohesive and c-φ soils.	
	Class 32	Planner method of stability analysis of finite slopes, Culmann's analysis,	
	Class 33	Properties of bentonite to be used in advancing boreholes for cast in situ piles, Limitations of bentonite method	
Week 12			
	Class 34	Effect of submergence and seepage on stability of infinite slopes.	CT 3
	Class 35	Different modes of circular finite slope failure, Mass method of stability of slopes.	
	Class 36	Actions to be taken before concreting of bored piles, Concreting of bored piles, Reverse circulation method	
Week 13			
	Class 37	Slices methods of stability of slopes, Ordinary method of slices,	

	Class 38	Various methods of determining centre or locus of slip surface.	
	Class 39	Ground Improvement Methods Soil Stabilization and Preloading	
Week 14			
	Class 40	Simplified Bishop method of stability analysis	
	Class 41	Taylor's chart.in analyzing stability of slopes.	
	Class 42	Ground Improvement Methods SCP and Stone Columns	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO4	C1,C2
	Class Participation	5%	CO2	C2
	Mid Term	15%	CO2, CO3	C2,C3
Final Exam		60%	CO1	C1, C2
			CO2	C2,C3
			CO3	C2, C3
			CO4	C2, C3, C4
			CO5	C2, C3, C4
Total Marks		100%		

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

REFERENCES 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

REFERENCE SITE

http://www.google.com

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 OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Explore the problems related to different geometric features of the highways including finding solutions to common challenges encountered.	PO – 1,5	C2	3		1	T, M, F
CO2	Forecast travel demands using contemporary methods for effective transportation planning.	PO – 2	C3	2,5		2,5	As g
CO3	Analyze traffic characteristics and flow parameters. They will also be able to plan and design two phase traffic signal, road sign, marking and street lighting.	PO – 1,3	C2	3		1	T, M. F
CO4	Investigate road traffic accident.	PO – 2,4	C4	1,4, 7		4,5	Pr
CO5	Have clear idea about different tools and functioning of ITS. They will also know the procedures for conducting TIA.	PO - 1	C2			1	M, F

**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>

(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)

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
CO1	Explore the problems related to different geometric features of the highways including finding solutions to common challenges encountered.	3				1							
CO2	Forecast travel demands using contemporary methods for effective transportation planning.		2										
CO3	Analyze traffic characteristics and flow parameters. They will also be able to plan and design two phase traffic signal, road sign, marking and street lighting.	3		1									
CO4	Investigate road traffic accident.		3		3								
CO5	Have clear idea about different tools and functioning of ITS. They will also know the procedures for conducting TIA.	2											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics and engineering fundamentals has to be applied to explore the problems related to geometric features and to find solutions to common problems.
	CO1 – PO5	1	In order to identify the problem and probable solutions related to geometric features of roadway, use of various modern equipment (Theodolite, total station, EDM etc) is necessary.
	CO2 – PO2	2	To forecast the travel demand it is necessary to use principles of mathematics and analyze complex problems in real situations.

	CO3 – PO1	3	Knowledge of mathematics and engineering fundamentals has to be applied to explore the problems related to traffic engineering and to find solutions to common problems.
	CO3 – PO3	1	Ability to design complex problems related to various regulatory measures eg. traffic signal, road sign, road markings etc.
	CO4 – PO2	3	Investigation of road traffic accident needs ability to identify and analyze complex engineering problems and also the gamut of transportation knowledge.
	CO4 – PO4	3	Investigation of road traffic accident needs the ability to collect, collate and analyze traffic/accident data and also the ability to investigate complex problems.
	CO5 – PO1	2	Apply the knowledge of mathematics, science and engineering fundamentals.

TEACHING AND LEARNING STRATEGY		
	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	56 -- --
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	12 24 63
	Formal Assessment • Continuous Assessment • Final Examination	2 3
	Total	160

TEACHING METHODOLOGY	
	Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1	Class 1	Introduction to traffic engineering	
	Class 2	Road traffic system and its components	

	Class 3	Traffic characteristics, vehicle characteristics and road user characteristics	
	Class 4	Traffic characteristics, vehicle characteristics and road user characteristics	
Week 2	Class 5	Traffic survey and studies	
	Class 6	Traffic volume studies	CT 1
	Class 7	Traffic volume studies	
	Class 8	Traffic speed studies	
Week 3	Class 9	Traffic speed studies	
	Class 10	Traffic delay studies	
	Class 11	Origin destination survey	
	Class 12	Parking studies	
Week 4	Class 13	Traffic Control Devices, traffic signs and road markings	
	Class 14	Traffic Control Devices, traffic signs and road markings	
	Class 15	Traffic signal, types and design	
	Class 16	Traffic signal, types and design	
Week 5	Class 17	Street lighting	
	Class 18	Terminals – Bus and truck terminals	
	Class 19	Elements of Geometric Design and design controls/criteria	
	Class 20	Traffic Elements of highway design and LOS	
Week 6	Class 21	Functional classification of road and road hierarchy	
	Class 22	Roadway cross-section and various elements of a road	
	Class 23	Roadway cross-section and various elements of a road	Mid Term Exam
	Class 24	Sight distances - Passing sight distance and stopping sight distance	
Week 7	Class 25	Sight distances - Passing sight distance and stopping sight distance	
	Class 26	Sight distances - Passing sight distance and stopping sight distance	
	Class 27	Super elevation and its characteristics	
	Class 28	Intersection- Design principle, alignment, classification	
Week 8	Class 29	Intersection- Design principle, alignment, classification	
	Class 30	Grade separation and interchange	CT 2
	Class 31	Grade separation and interchange	
	Class 32	Horizontal alignment and horizontal curves	
Week 9	Class 33	Vertical alignment and vertical curves	
	Class 34	Basic elements of transportation planning and concepts	
	Class 35	Basic elements of transportation planning and concepts	
	Class 36	Scope of transportation planning, goals and	

		objectives	
Week 10	Class 37	Classification of transportation system and functional classification of land transport system	
	Class 38	Socio-economic activities and land use pattern-transport iteration	CT-3
	Class 39	Data collection and travel surveys	
	Class 40	Travel demand forecasting, trip generation, trip distribution and modal split	
Week 11	Class 41	Travel demand forecasting, trip generation, trip distribution and modal split	
	Class 42	Travel demand forecasting, trip generation, trip distribution and modal split	
	Class 43	Transportation system of Bangladesh	
	Class 44	Pavement and its types	
Week 12	Class 45	Function of various pavements	CT 4
	Class 46	Materials used in pavement construction	
	Class 47	Aggregates - classification and properties	
	Class 48	Aggregates - classification and properties	
Week 13	Class 49	Bituminous materials – classification and properties	
	Class 50	Bituminous materials – classification and properties	
	Class 51	Flexible pavement design	
	Class 52	Flexible pavement design	
Week 14	Class 53	Rigid pavement design	
	Class 54	Rigid pavement design	
	Class 55	Intelligent transportation system	
	Class 56	Intelligent transportation system	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-4)	20%	CO1, CO2, CO3	C2, C3, C4
	Class Participation	5%	CO 1-5	C1, C2
	Mid Term	15%	CO1, CO3, CO5	C1, C2
Final Exam (60%)		60%	CO 1-5	C1, C2
Total Marks		100%		

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

REFERENCES 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
REFERENCE SITE
http://classroom.google.com/...../.........

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 OUTCOMES & GENERIC SKILLS	

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO 1	Students will be able to design mixture of highway materials	PO – 2,3	C4	1,3		3	Q, R
CO 2	Students will be able to understand the parameters for quality control of highway materials	PO – 1	C2	4		1	Q, R

**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)

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
CO1	Students will be able to design mixture of highway materials		2	3									

CO2	Students will be able to understand the parameters for quality control of highway materials	3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO2	3	Knowledge of mathematics and engineering fundamentals has to be applied to explore the problems related to mixture needed for proposed highway construction.
	CO1 – PO3	1	Will be able to find viable solution to the problem and design the necessary mixture for proposed highway.
	CO2 – PO1	2	Knowledge of science and engineering fundamentals has to be applied to understand the parameters for quality control of highway materials.

TEACHING AND LEARNING STRATEGY

	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	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, Practical/Lab sessional

COURSE SCHEDULE

		Intended Topics to be Covered	**Assessment**
Week 1	Class 1	Determination of aggregate impact value (AIV) Determination of aggregate crashing value (ACV)	

Week 2	Class 2	Determination of ten percent fines value Determination of angularity number	Quiz Test, Reports, Class participation, Viva
Week 3	Class 3	Determination of flakiness index Determination of elongation index	
Week 4	Class 4	Specific gravity of semi-solid bituminous materials	
Week 5	Class 5	Loss on heating of oil and asphaltic compounds	
Week 6	Class 6	Penetration of bituminous materials	
Week 7	Class 7	Softening point of bituminous materials	
Week 8	Class 8	Ductility of bituminous materials	
Week 9	Class 9	Flash and fire points of bituminous materials	
Week 10	Class 10	Determination of roadway capacity. Measuring saturation flow at traffic signals	
Week 11	Class 11	Standard test method for CBR of laboratory compacted soils	
Week 12	Class 12	Marshal method of mix design	
Week 13	Class 13	Final Quiz Test	
Week 14	Class 14	Viva voce	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment	Reports	20%	CO1, CO2	C2
	Class attendance and Participation	10%	CO1, CO2, CO3	C2
Quiz-1		30%	CO1, CO2	C1
Quiz-2		30%	CO1, CO2	C1
Viva voce		10%	CO1, CO2, CO3	C4
Total Marks		100%		

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

REFERENCES BOOKS

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

REFERENCE SITE

http://classroom.google.com/...../.........

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 is the fundamental course on open channel flow where students will be introduced with basic knowledge on open channel system, energy and momentum theories for open channel flow and designing of open channel.
OBJECTIVE
1. To gain knowledge on the basics of open channel flow focusing critical, uniform and gradually varied flow and how those are different from pipe flows. 2. To devise the energy and momentum theories for flow through open channels. 3. To become skilled at the design of channels and computation of flow profiles.
COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **devise** the energy and momentum theories for flow through open channels	PO-1	C6	1		1,3	Assg/ T, M
CO2	Be able to **apply** the Manning's and Chezy's equation in measurement of channel parameters	PO-2	C3	1,2		1,2,3	Assg, T, M
CO3	Be able to **estimate** energy dissipation due to hydraulic jumps in open flows	PO-2	C5	1,2,4		2,3	Assg, T, F
CO4	Be able to **design** different type of channels and **compute** numerically the flow profiles	PO-3	C6	1, 4,5		4	Assg, T, F

**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)

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
CO1	Be able to **devise** the energy and momentum theories for flow through open channels	3											
CO2	Be able to **apply** the Manning's and Chezy's equation in measurement of channel parameters		2										
CO3	Be able to **estimate** energy dissipation due to hydraulic jumps in open flows		3										
CO4	Be able to **design** different type of channels and **compute** numerically the flow profiles			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to understand energy nad momentum principles for open channel flow.
	CO2 – PO2	2	To identify, formulate and analyze open channel flow behavior and to estimate open channel flow parameters
	CO3– PO2	3	To estimate energy dissipation and forces in open channel flows and to analyze open channel flow problems through the first principles of mathematics, natural science and engineering sciences.
	CO4-PO3	3	Able to design different type of channels to solve practical open channel flow problems and to compute flow profiles

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 final examination	 9 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120
TEACHING METHODOLOGY		
Lecture, Problem Based Method		
COURSE SCHEDULE		

		Intended Topics to be Covered	Assessment
Week 1			Asg, M
	Class 1	Basic concepts of Open Channel Flow	
	Class 2	Characteristics of open channel flow	
	Class 3	Effect of gravity and viscosity on flow	
Week 2			
	Class 4	Velocity and pressure distribution	
	Class 5	Correction factors for velocity and momentum	
	Class 6	Continuity and Energy equation	
Week 3			
	Class 7	Concept of Specific energy, specific energy curve	T,M
	Class 8	Transition problem	
	Class 9	Concept of Critical flow	
Week 4			Asg, M
	Class 10	Theories related to critical flow	
	Class 11	Computation of critical depths: analytical method	
	Class 12	Computation of critical depths: trial and error method	
Week 5			
	Class 13	Concept of uniform flow	
	Class 14	Uniform flow formulas	
	Class 15	Chezy's and Manning's equation	
Week 6			
	Class 16	Resistance coefficients	T,M
	Class 17	Computation of normal depth	
	Class 18	Uniform flow for complex channels	
Week 7			
	Class 19	Hydraulic exponent for uniform flow computation	
	Class 20	Computation of normal and critical slopes	
	Class 21	Channel sections with composite roughness	Asg, F
Week 8			
	Class 22	Compound Cross-sections	
	Class 23	Principles of flow measurement and devices	
	Class 24	Gradually Varied Flow (GVF): definition	
Week 9			
	Class 25	Dynamic equations of GVF, channel slopes	
	Class 26	Flow profiles on Mild and Steep slopes	

	Class 27	Flow profiles on Critical, Horizontal and Adverse slopes	
Week 10			T
	Class 28	Draw simple profiles	
	Class 29	Practice complex profiles	
	Class 30	Calculation of critical and uniform depths	
Week 11			
	Class 31	Calculation of simple flow profiles	
	Class 32	Description of Direct Step method	Asg,F
	Class 33	Numerical computation of flow profiles using direct step method	
Week 12			
	Class 34	Hydraulic Jump: definition, practical use, types etc	
	Class 35	Hydraulic Jump: derivation of different theories	
	Class 36	Hydraulic Jump: computation of jumps and losses of energies	
Week 13			
	Class 37	Design of Channels: basics, definition, design of simple channels	
	Class 38	Design of best hydraulic sections	
	Class 39	Design of erodible channels (theory)	
Week 14			
	Class 40	Design examples of erodible channels	
	Class 41	Design of Alluvial channels: theory	
	Class 42	Design examples of Alluvial channels	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1,CO2,CO4	C6,C3,C6
	Class Participation	5%	CO2,CO3,CO4	C3,C5,C6
	Mid Term	15%	CO1,CO2	C6,C3
Final Exam		60%	CO1	C6
			CO1	C3
			CO1	C5
			CO1	C6
Total Marks		100%		

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

REFERENCES 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
5. Open Channel Flow - F M Henderson

REFERENCE SITE

https://www.google.com

COURSE INFORMATION	
Course Code: EWCE 362	Credit Hour: 1.5
Course Title: Open Channel Hydraulics Sessional	Contact Hour: 1.5
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 the energy and momentum theories for flow through open channels. 3. To setup a 1D steady River flow model and interpret model results.	
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 open channels with velocity and discharge variation.	PO-1	C2	1,4		1, 3,6	R,M, F
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.	PO-2	C6	1,4		1, 3,6	R,M, F
CO3	Be able to **apply** the theories of energy and force on open channel flows.	PO-2	C3	1,4		1, 3,6	R,F

**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)

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, 1D steady river flow model setup, model interpretation.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **understand** the state of flow while passing through open channels with velocity and discharge variation.	3											
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.		2										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to understand flow behavior and to calculate flow parameters in an open channel.
	CO2 – PO2	3	Able to identify, formulate and analyze open channel flow profiles and estimate losses of energy when open channel flows passing through different hydraulic structures
	CO3– PO2	2	Able to estimate energy and forces in open channel flows and to analyze open channel flow problems through the first principles of mathematics, natural science and engineering sciences.

TEACHING AND LEARNING STRATEGY

	Teaching and Learning Activities	Engagement (Hours)

	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	12 24 --	
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	12 12 14	
	Formal Assessment • Continuous Assessment • Final Examination	24 1.5	
	Total	99.5	
TEACHING METHODOLOGY			
Lecture, Laboratory Experiments, Class Assessment			
COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			R, Asg, M
	Class 1	Introduction to Open Channel flow and different devices to be used throughout this Course	
Week 2			
	Class 2	Determination of state of flow and critical depth in open channel flow	
Week 3			
	Class 3	Flow over Broad Crested Weir	
Week 4			
	Class 4	Flow Through a Venturi Flume	
Week 5			
	Class 5	Flow Through a Parshall Flume	
Week 6			
	Class 6	Class works on different mathematical problems	
Week 7			
	Class 7	Mid Term Quiz	
Week 8			
	Class 8	Flow Beneath a Sluice Gate	R, Asg, F
Week 9			
	Class 9	Determination Discharge and Mean Velocity of an Open Channel	
Week 10			
	Class 10	Determination of Change in Water Level due to Raised Channel Bottom	
Week 11			
	Class 11	Development and Generalized Specific Energy and Specific Force Curves	
Week 12			
	Class 12	Study on Hydraulic Jump	
Week 13			
	Class 13	Final Quiz	
Week 14			

	Class 14	Viva	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Lab Reports	15%	CO1, CO2, CO3	C1, C6,C3
	Class Participation	10%	CO1, CO2, CO3	C1, C6,C3
	Mid Term	15%	CO1,CO2	C1, C6
Final Exam and Viva		60%	CO1	C1
			CO2	C6
			CO3	C3
Total Marks		100%		

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

REFERENCES BOOKS

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

REFERENCE SITE

https://www.google.com

COURSE INFORMATION

Course Code: GEPM 375 Course Title: Project Planning and Construction Management	Credit hours: 2.00 Contact hours: 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course is to gain knowledge on principles of project management, human resource management, project planning. It is design to develop skills to perform project scheduling, project appraisals, resource allocation by operation research technique which will be useful in in their professional life.

OBJECTIVE

1. To gain knowledge on principles of project management & organizations, conflict management, human resource management, inventory management, demand forecasting and construction site management.
2. To develop skills for evaluating a project based on BCR, NPV, IRR, and PBP.
3. To execute allocation of resources by linear programming and plan a project by 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.

COURSE OUTCOMES AND SKILL MAPPING

No.	COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Ability to **explain** principles of project management & organizations, human resource management, inventory management, demand forecasting and construction site management	√	√										
CO2	Ability to **plan** a project schedule by network techniques and project management software and **execute** allocation of resources by linear programming			√									
CO3	Ability to **apprise** a project based on BCR, NPV, IRR, PBP				√								

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **explain** principles of project management &	1, 2	C1/C2	1, 2		3 Class Test,	Assignment, Mid-term,

	organizations, human resource management, inventory management, demand forecasting and construction site management						Pop quiz, Final Exam
CO2	Ability to **plan** a project schedule by network techniques and project management software and **execute** allocation of resources by linear programming	3	C4	2		3, 4 Class Test,	Assignment, Mid-term, Pop quiz, Final Exam
CO3	Ability to **apprise** a project based on BCR, NPV, IRR, PBP	4	C5	3		3, 4 Class Test,	Assignment, 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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (3 hours/week x 14 weeks)	42
Guided Learning Tutorial/ Assignments (3 hours/week x 5 weeks)	15
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	 36 22
Assessment Continuous Assessment Final examination	 2 3
Total	120

TEACHING METHODOLOGY

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

TEACHING SCHEDULE

Week	Lectures	Topics	Assessments
1	1	Definition and characteristics of a project	CT/ Assignment-1
	2	Principles of Project Management	
	3	Principles of Project Management	
2	4	Feasibility study, feasibility report	
	5	Introduction to Construction Planning and Management	
	6	Project Organization: Methods and Practices, Technology	

3	7	Project life, time value of money, compounding and discounting formulas	
	8	Project Organization: Methods and Practices, Technology	
	9	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	
	33	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	Blooms Taxonomy
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C4, C5
Final Exam	60%	CO 1	C1, C2
		CO 2	C4
		CO 3	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.
REFERENCE SITE
http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 400	Credit Hour: 4.0
Course Title: Final Year Research Project (FYP)	Contact Hour: 12.0
PRE-REQUISITE	
-	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
This course will enable the students identifying real life problems, performing background studies, brainstorming, assessing the problems, drawing interpretations and recommending 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 thinkers 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 consists of faculty member(s).	

COURSE INFORMATION	
Course Code: EWCE 411	Credit Hour: 2.0
Course Title: Structural Analysis and Design II	Contact Hour: 2.0
PRE-REQUISITE	
EWCE 101 (Analytic Mechanics) , EWCE 211 (Mechanics of Solids) , EWCE 311 (Structural Analysis and Design I)	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
This is the second course on structural analysis. In this course students will learn how to analysis various structural components of indeterminate 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.	
OBJECTIVE	
1. To gain knowledge on the basics of solving indeterminate structure. 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 devise the theories to get ordinate of influence line.	

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Ability to **analyze** statically indeterminate problems.	PO – 2	C4	1		1, 3,4	CT,M, F
CO2	Ability to **develop** algorithms by using direct stiffness method.	PO – 2	C6	1,3		4,5	M, F
CO3	Ability to **solve** influence lines for statically indeterminate structures.	PO – 2	C4	1		4, 5,6	Asg/ CT, F
CO4	Ability to **develop** understanding of the basic principles of structural analysis.	PO – 1, 2	C2, C5	1,3		4,5	Asg/ F

**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)

COURSE CONTENT
Analysis of statically indeterminate beams and frames by moment distribution and stiffness methods, algorithms for implementing direct stiffness method using computer,

influence lines of statically indeterminate beams.
SKILL MAPPING (CO – PO MAPPING)

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

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO2	3	Knowledge of stiffness method, moment distribution method and flexibility method will be applied to solve different indeterminate structures like beam, frame and truss.
	CO2 – PO2	2	Using the knowledge of stiffness method, student can write down stiffness matrix for multiple degrees of freedoms.
	CO3 – PO2	3	Students will be able to draw shape of influence line of any indeterminate structures. The value of ordinate can be found out using knowledge of flexibility method.
	CO4 – PO1	2	Ability for problem formulation and analysis using mathematics, natural science and engineering fundamentals are required for analysis of indeterminate structures.
	CO4 – PO2	3	Ability to formulate any engineering problems and solve those complex engineering problems.

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	 6

	• Revision of the previous lecture at home • Preparation for final examination		12 29
	Formal Assessment • Continuous Assessment • Final Examination		2 3
	Total		80
TEACHING METHODOLOGY			
Lecture and Discussion, Problem Based Method			
COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Course overview & Fundamental principles and methods of structural analysis	
	Class 2	Basic of moment distribution method	
Week 2			
	Class 3	Moment distribution method – Beam I	
	Class 4	Moment distribution method - Beam II	
Week 3			
	Class 5	Moment distribution method – Beam III	
	Class 6	Moment distribution method - Beam IV	
Week 4			CT-1
	Class 7	Moment distribution method - Frame I	
	Class 8	Moment distribution method - Frame II	
Week 5			
	Class 9	Moment distribution method - Frame III	
	Class 10	Moment distribution method - Frame IV	
Week 6			Mid Term Examination
	Class 11	Moment distribution method - Frame V	
	Class 12	Moment distribution method - Frame VI	
Week 7			
	Class 13	Basic of Stiffness method	
	Class 14	Stiffness method – Beam I	
Week 8			CT 2
	Class 15	Stiffness method – Beam II	
	Class 16	Stiffness method – Beam III	
Week 9			
	Class 17	Stiffness method – Plane Grid	
	Class 18	Stiffness method – Frame I	
Week 10			
	Class 19	Stiffness method – Frame II	
	Class 20	Stiffness method – Frame III	
Week 11			
	Class 21	Stiffness method – Frame IV	
	Class 22	Stiffness method – Frame V	

Week 12			
	Class 23	Stiffness method – Truss	
	Class 24	Developing algorithm for multiple degree of freedom.	
Week 13			
	Class 25	Basics of Influence line	
	Class 26	Influence line of indeterminate structures- Beam I	
Week 14			
	Class 27	Influence line of indeterminate structures- Beam II	
	Class 28	Influence line of indeterminate structures- Beam III	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO3	
	Class Participation	5%	CO1 , CO2	
	Mid Term	15%	CO2	
Final Exam		60%	CO1	C1, C2, C4
			CO2	C6
			CO3	C2 , C4, C5
			CO4	C2, C4
Total Marks		100%		

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

REFERENCES BOOKS

1. Structural Analysis, R C. Hibbeler, Prentice Hall, 8th Edition.
2. Indeterminate Structural Analysis, C K Wang, McGraw-Hill International Editions.
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 (4 th Edition).

REFERENCE SITE

http://classroom.google.com/...../.........

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 as well as ESIA for various development projects which will be very 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 OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to **understand** the basic components of environment and ecology	PO – 1	C2	1		1	T,Q,Asg,F
CO2	Able to **understand** the basic environmental processes and pollution scenarios	PO – 2,3,4	C2	1, 5		2	T, Q, Asg,F
CO3	Able to **know** the basics of producing ESIA report for wide range of projects	PO – 6,7,8	C2	2,4,5		7	T, Q, Asg,F
CO4	Able to **use** basic knowledge for the assessment of possible impacts of any development project	PO – 9	C3	5,6		5,7	T, Q, Asg,F

**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)

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. Environmental laws and regulations.

Preparation of Environmental management and monitoring plan, Environmental Issues in Bangladesh, Population displacement, rehabilitation strategy, Public Participation in Environmental Decision and losses, socio-economic survey, case studies. Gender issues, Legal aspects of EIA.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Able to **understand** the basic components of environment and	3											

	ecology												
CO2	Able to **understand** the basic environmental processes and pollution scenarios		2	2	2								
CO3	Able to **know** the basics of producing ESIA report for wide range of projects						3	3	3				
CO4	Able to **use** basic knowledge for the assessment of possible impacts of any development project									3			

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

Mapping	Corresponding Level of Matching	Justifications
CO1 – PO1	3	Knowledge of mathematics and Engineering have to be applied to understand the basic components of environment and ecology.
CO2 – PO2	2	Knowledge of complex Engineering problem is required to understand the basic environmental processes and pollution scenarios.
CO2 – PO3	2	In order to control pollution, knowledge of design solution is required.
CO2 – PO4	2	Investigation of the actual problem is very much necessary to understand the nature of environmental pollution
CO3- PO6	3	Engineering ethics, economics and sustainability are the key prerequisite to for producing a standard ESIA report
CO3- PO7	3	Understanding the effectiveness and sustainability of a development project in societal context is very necessary for an ESIA report
CO3- PO8	3	Understanding ethical issues is mandatory for the assessment of social impact of any project.
CO3- PO9	3	Team of the people of various disciplines is very necessary to ultimately assess the impact of any development project.

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 final examination	09 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
Week 1			CT 1
	Class 1	Concept of Environment	
	Class 2	Introduction to Environmental Management	
	Class 3	Goals of Environmental Management	
Week 2			
	Class 4	Major Environmental Issues in Bangladesh	
	Class 5	Formulation of Environmental Policy	
	Class 6	Environmental Policy in Bangladesh	
Week 3			Mid Term
	Class 7	History of Environmental Laws	
	Class 8	Environmental Laws in Bangladesh Period	
	Class 9	Assessing critically endangered zone	
Week 4			
	Class 10	Process of Environmental Clearance Certificate	
	Class 11	Objectives of EIA	
	Class 12	Focus Group Discussion	
Week 5			
	Class 13	Steps of EIA	
	Class 14	Scope of EIA	
	Class 15	Environmental Management Plan	
Week 6			
	Class 16	EIA Methodologies	
	Class 17	Composition of EIA Team	
	Class 18	Environmental Quality Standards	
Week 7			
	Class 19	Impact Chain Approach	
	Class 20	Purpose of Setting Standard and Limitations	
	Class 21	Importance of EMP in EIA	
Week 8			
	Class 22	Project Cycle and EIA	
	Class 23	Format of EMP	
	Class 24	Typical content of EMP Report	
Week 9			CT 2
	Class 25	EIA in water resources and industrial projects, Different EIA index calculation. Environmental laws and regulations	
	Class 26	Application of EIA, EIA for protection measures	

	Class 27	EIA of draughts in dry season, rainy season, impact of flood, solid waste management etc	
Week 10			
	Class 28	Economic and social structure in an ESIA report population,,	
	Class 29	Development and economic growth assessment	
	Class 30	Introduction to socio-economic indicators	
Week 11			
	Class 31	Rehabilitation strategy during EMP	
	Class 32	Productivity, land loss, land use and land ownership pattern assessment	
	Class 33	Analysis of communication, commerce, industries and other economic benefits	
Week 12			
	Class 34	Analysis of inequalities in distribution of benefits and losses	CT 3
	Class 35	Social Survey	
	Class 36	Economic and Financial analysis	
Week 13			
	Class 37	Gender issues in an ESIA report	
	Class 38	Legal aspects of EIA	
	Class 39	Case studies	
Week 14			
	Class 40	Example of EIA report	
	Class 41	Example of EIA report	
	Class 42	Review of procedure of EIA Report	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO4	
	Class Participation	5%	CO2	
	Mid Term	15%	CO1, CO3	
Final Exam		60%	CO1	C2
			CO2	C2
			CO3	C2
			CO4	C3
Total Marks		100%		

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

REFERENCES 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.
4. Methods of Environmental Impact assessment - Therivel, Riki, 1st Ed. UCL press.

REFERENCE SITE

http://classroom.google.com/...../.........

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, waste water discharge, design water wells, 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 students efficient in performing plumbing design, sewer system design, water distribution design for any building, residential/ industrial area.	
COURSE OUTCOMES & GENERIC SKILLS	

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Become skilled enough to **identify** the fresh water supply requirement, waste water discharge, storm water flow and sanitation requirement in urban as well as rural areas.	PO – 2,7	C2		4	1,4	M,R, V
CO2	Be able to **design** and construct water wells, sanitary sewer, storm sewer, septic tanks	PO –3	C6		1,3	1,5, 6	M,R, V
CO3	Be able to **design** and construct waste water treatment plants and sewage treatment options.	PO – 3	C6		1,3	1,5, 6	F,R, V
CO4	Be able to **design** house plumbing facilities efficiently	PO –3	C6		1,3	1,5, 6	F, R,V

* *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>

(CP – Complex Problems, CA – Complex Activities, KP – Knowledge Profile, M – Mid Quiz, R – Report, F – Final Quiz, V-Viva.)

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
CO1	Become skilled enough to predict the fresh water supply requirement, waste water discharge, storm water flow and sanitation requirement in urban as well as rural areas.		3					2					
CO2	Be able to design and construct water wells, sanitary sewer, storm sewer, septic tanks			3									
CO3	Be able to design and construct waste water treatment plants and sewage treatment options.			3									
CO4	Be able to design house plumbing facilities efficiently			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO2	3	In order to identify the fresh water supply requirement, waste water discharge, storm water flow and sanitation requirement in urban as well as rural areas.
	CO1 – PO7	2	Ability to understand and evaluate the sustainability and impact of constructing community water supply distribution networks, sanitation requirements in urban as well as rural areas.
	CO2– PO3	3	Ability to design and construct water wells, sanitary sewer, storm sewer, septic tanks
	CO3 – PO3	3	Ability to design and construct waste water treatment plants and sewage treatment options.
	CO4 – PO3	3	Ability to design house plumbing facilities efficiently

TEACHING AND LEARNING STRATEGY

	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture	36

	Guided Learning • Report	08
	Self-directed Learning • Individual learning	13
	Formal Assessment • Quiz+ Viva	3
	Total	60
TEACHING METHODOLOGY		
Lecture and Discussion, Problem Based Learning		
COURSE SCHEDULE		

		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction	
Week 2			
	Class 2	Layout of Industrial Village	
	Class 3	Preparation of Organograms	
Week 3			
	Class 4	Population Estimation of the Industrial Village	
Week 4			
	Class 5	Water Demand Calculation for Residential Zone of the Industrial Village	
Week 5			
	Class 6	Water Demand Calculation for Commercial Zone of the Industrial Village	
	Class 7	Water Demand Calculation for Industrial Zone of the Industrial Village	
Week 6			
	Class 8	Development of Water Source for the Industrial Village	
Week 7			
	Class 9	Mid Term Quiz + Viva	
Week 8			
	Class 10	Determination of Pump Capacity & Pumping Schedule	
Week 9			
	Class 11	Design of Water Distribution Network (Branch Network)	
Week 10			
	Class 12	Design of Water Distribution Network (Branch Network)	
Week 11			
	Class 13	Design of Sanitary Waste Water System: Sanitary Sewer Design	
Week 12			
	Class 14	Design of Plumbing System of a 10 Storied Building	
Week 13			
	Class 15	Design of Water Supply and Drainage Network of a 10 Storied Building	

Week 14			
	Class 16	Final Quiz +Viva	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Viva	10%	CO1,CO2,CO3,CO4	
Class Work	10%	CO2,CO3,CO4	
Report	20%	CO2,CO3,CO4	
Quiz(Mid Term+ Final)	60%	CO1	C2,C4
		CO2	C3
		CO3	C3
		CO4	C3
Total Marks	100%		

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

REFERENCES 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.

REFERENCE SITE

http://classroom.google.com/

COURSE INFORMATION	
Course Code: EWCE 433	Credit Hour: 3.00
Course Title: Solid and Hazardous Waste Management	Contact Hour: 3.00

PRE-REQUISITE

EWCE 333 (Waste Water Engineering and Sanitation)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

The students will learn about the sources and complete management of solid, hazardous and medical wastes, which will help them to design 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 characteristics of solid and hazardous waste. 2. To address the collection, storage, transfer, treatment and disposal options of different wastes. 3. To assess the potential of resource recovery. 4. To design efficient waste management system for the community.

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.	PO – 1	C2	1		1,3	T, M, F
CO2	Ability to **analyze** health and environmental issues related to solid and hazardous waste management.	PO – 2	C4	3		3	T, M, F
CO3	Ability to **solve** various steps in solid waste management-waste reduction at source, collection techniques, materials and resource recovery/recycling, optimization of solid waste transport, treatment and disposal techniques.	PO – 3	C3	1,3,4		4, 5, 6	T,F

**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)

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

CO1	Ability to **understand** the characterization of different kinds of solid and hazardous wastes and their treatment.	3											
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-waste reduction at source, collection techniques, materials and resource recovery/recycling, optimization of solid waste transport, treatment and disposal techniques.			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Ability to **understand** the characterization of different kinds of solid and hazardous wastes and their treatment.
	CO2 – PO2	3	Ability to **analyze** health and environmental issues related to solid and hazardous waste management.
	CO3 – PO3	3	Ability to **solve** various steps in solid waste management-waste reduction at source, collection techniques, materials and resource recovery/recycling, optimization of solid waste transport, treatment and disposal techniques.

TEACHING AND LEARNING STRATEGY

	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 42 15 --
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 12 18 27
	Formal Assessment • Continuous Assessment (Pop Quiz/Class Test/Mid	 3

	Term Exam) • Final Examination		3
	Total		120
TEACHING METHODOLOGY			
Lecture, Tutorial, Problem Based Method			
COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to solid waste management, Types and composition of Solid Waste, Characteristics of Solid Waste	
	Class 2	Characterization of hazardous waste	
	Class 3	Exposure to hazardous waste, Effects of toxicity, Dose – Response relationships	
Week 2			
	Class 4	Solid waste generation, sources and characterization of solid wastes	
	Class 5	Noncarcinogens, assessment of noncarcinogenic risk, Carcinogens, testing for carcinogenicity, dose-response relationships for carcinogens	
	Class 6	Hazardous waste management strategies, Volume reduction – process modification, segregation, reuse	
Week 3			
	Class 7	Functional Elements of Solid Waste Management System, Rationale Steps in Integrated Solid Waste Management	
	Class 8	Toxicity reduction of hazardous waste – process modification, equipment modification, material substitution	CT 1
	Class 9	Recycling and exchange of hazardous waste	
Week 4			
	Class 10	Generation, on-site handling and transfer of solid wastes	
	Class 11	Treatment methods for hazardous waste, Physicochemical treatment processes	
	Class 12	Biological treatment processes for hazardous waste	
Week 5			
	Class 13	Composting of solid waste	Mid Term Exam
	Class 14	Stabilization and solidification of hazardous waste	
	Class 15	Thermal treatment methods for hazardous waste	
Week 6			
	Class 16	Phases of chemical decomposition of solid waste	
	Class 17	Disposal methods for hazardous waste	
	Class 18	Characterization of healthcare waste (HCW)	
Week 7			

	Class 19	Factors affecting organic breakdown	
	Class 20	Characterization of healthcare waste (HCW)	
	Class 21	Healthcare waste (HCW) generation	
Week 8			
	Class 22	Types of landfill, methods of landfill	CT 2
	Class 23	Landfill operation	
	Class 24	Risk associated with healthcare waste (HCW)	
Week 9			
	Class 25	Pollution from Landfill	
	Class 26	Landfill Design	
	Class 27	Hazards from infectious waste, sharps, chemical waste, pharmaceutical waste, radioactive waste, Hazards from healthcare waste treatment methods	
Week 10			
	Class 28	Sanitary Landfill and Design	
	Class 29	Decomposition of Solid Wastes in landfills	
	Class 30	Public health impacts of HCW	
Week 11			
	Class 31	Ultimate Disposal of Solid Waste: Method	CT 3
	Class 32	Resources and energy recovery and recycling	
	Class 33	HCW management - Waste minimization, safe reuse, recycling and recovery	
Week 12			
	Class 34	Legal and financial aspects of waste management I	
	Class 35	Legal and financial aspects of waste management I	
	Class 36	HCW management - Segregation systems, waste containers, segregation standard, Collection from healthcare facilities,	
Week 13			
	Class 37	Interim storage in medical departments, Central storage inside healthcare facilities	
	Class 38	Onsite and Offsite transport of healthcare waste	
	Class 39	HCW treatment technologies I – thermal, chemical, and irradiation processes	
Week 14			
	Class 40	HCW treatment technologies II –biological and mechanical processes	
	Class 41	Treatment for specific HCW categories – pharmaceuticals, chemicals and wastes containing heavy metals	
	Class 42	Disposal methods for healthcare waste	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom’s Taxonomy

Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO3	C2, C3
	Class Participation	5%		
	Mid Term	15%		
Final Exam		60%	CO1	C2
			CO2	C4
			CO3	C3
Total Marks		100%		

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

REFERENCES BOOKS

1. Solid and Hazardous Waste Management - M. Habibur Rahman and Abdullah AlMuyeed 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.

REFERENCE SITE

http://www.google.com

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 Engineering), 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 surrounding environment, like water, air, soil, noise level etc. which will help them to apply their knowledge in professional life.

OBJECTIVE

1. To gain knowledge on 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.

COURSE OUTCOMES & GENERIC SKILLS

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

CO1	Demonstrate an **understanding** of the basics of different environmental models	PO – 2	C2	1	1,2	6	Cp, R, Q
CO2	Be expert in to **applying** models to predict and compute environmental pollution	PO – 5	C3	1,3	1	7	Cp, R, Q
CO3	Be proficient in **evaluating** results of environmental models and co relate them with physical phenomena	PO – 4, 7	C5	1, 5	1	6	Cp, R, Q

**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, Cp-Class Performance)

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
CO1	Demonstrate an **understanding** of the basics of different environmental models		2										
CO2	Be expert in to **applying** models to predict and compute environmental pollution					3							
CO3	Be proficient in **evaluating** results of environmental models and co relate them with physical phenomena				3			2					

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO2	2	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to

			understand how the models work.
	CO2 – PO3	3	In order to get a valid result, selection and application of appropriate data, techniques, resources, and modern engineering and IT tools with an understanding of the limitations is required.
	CO3 – PO4	3	To evaluate the modeling results, analysis and interpretation of data, and synthesis of information is required.
	CO3 – PO7	2	Emission models shows environmental impacts of professional engineering works which develops concerns in environmental context.
TEACHING AND LEARNING STRATEGY			
	Teaching and Learning Activities		Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning		 7 28 --
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for Mid Quiz • Preparation for Final Quiz		 14 18 6 8
	Formal Assessment • Continuous Assessment • Mid Quiz • Final Quiz		 7 1 1
	Total		90
TEACHING METHODOLOGY			
Lectures, Software Demonstrations			
COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Basic Components and processes, and internal dynamics of a water supply system	R, Q
Week 2			
	Class 2	Modeling concept, a thorough insight of WaterNAM and how a model like WaterNAM can be used to construct a virtual system, and a quick overview of the features, processes, and data	Cp, R, Q

		management steps in WaterNAM	
Week 3			
	Class 3	Hands-on practice of developing a distribution network	Cp, Q
Week 4			
	Class 4	Demonstrations of different analysis methods i.e. distribution main design, sensitivity analysis etc. in steady-state simulation I	R, Q
Week 5			
	Class 5	Demonstrations of different analysis methods i.e. distribution main design, sensitivity analysis etc. in steady-state simulation II	Cp, R, Q
Week 6			
	Class 6	Demonstrations of different analysis methods i.e. distribution main design, sensitivity analysis etc. in extended period	Cp, R, Q
Week 7			
	Class 7	Hands-on practice of analyzing distribution networks	Cp, R, Q
Week 8			
	Class 8	Environmental Noise Modelling and its application I	R, Q
Week 9			
	Class 9	Environmental Noise Modelling and its application II	Cp, R, Q
Week 10			
	Class 10	Physics of Air Dispersion	R, Q
Week 11			
	Class 11	Hands on Meteorological Data Analysis	Cp, R, Q
Week 12			
	Class 12	Refined Model introduction, overview and data input for AERMOD	Cp, R, Q
Week 13			
	Class 13	Coordinate systems and maps, Terrain processing	Cp, R, Q
Week 14			
	Class 14	Understanding puff and plume models	R,Q
ASSESSMENT STRATEGY			

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Performance	30%	CO1, CO3, CO4	C2, C3
	Observation	5%		
	Report	15%	CO1, CO3, CO4	C2, C4
Quiz		50% (25+25)	CO2	C2
			CO1, CO3, CO4	C2
Total Marks		100%		

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

REFERENCES BOOKS
1. A Step-by-Step Guide to EPANET 2.0 Simulations – Robert Pitt, Shirley Clark 3. A Text Book of Water Supply Engineering - M. A. Aziz, 1st ed., Hafiz Book Center 4. WaterNAM Online Example Set 5. SoundPLAN User's manual 6 AERMOD Quick Reference Guide - USEPA 7. AERMOD Tech Guide – Lakes Environmental
REFERENCE SITE
http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 435	Credit Hour: 2.0
Course Title: Air Pollution & Control	Contact Hour: 2.0
PRE-REQUISITE	
Chem-101 (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 air pollution control and management system.	
COURSE OUTCOMES & GENERIC SKILLS	

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

CO1	Be skillful to **apply** their understanding for air pollution management to ensure health safety	PO – 1,7	C2, C3	1,4		1, 4	T, F
CO2	Be able to **design** a smart, green and air pollution free urban community	PO – 2,3	C3	1, 5		1, 5	T, M, F
CO3	Be proficient to **design** air quality monitoring and abatement systems	PO – 2,3	C3	1, 5		1, 5	Asg / CT, M, F
CO4	Be expert in **analyzing** the root cause of air pollution and also to control such pollution	PO – 2,4	C4	1, 3		1, 8	F, Pr

**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)

COURSE CONTENT

Sources, classification and effects of air pollutants, air pollution regulations: air quality standards, emission standards, pollution indices, pollutants from combustion process, air pollution and meteorology: atmospheric properties, lapse rates and stability, atmospheric diffusion theories, Gaussian plume models, Indoor air quality, Air quality monitoring, Introduction to air quality models, Air pollution management and control measures: atmospheric removal and engineered systems.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be skillful to **apply** their understanding for air pollution management to ensure health safety	3						2					
CO2	Be able to **design** a smart, green and air pollution free urban community		3	3									
CO3	Be proficient to **design** air quality monitoring and abatement systems		3	3									
CO4	Be expert in **analyzing** the root cause of air pollution and also to control such pollution		3		2								

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to understand the air pollution management to ensure health safety
	CO1– PO7	2	Ability to understand the impact of professional engineering solutions in societal and environmental contexts to ensure health safety
	CO2 – PO2	3	Ability to identify, formulate, research literature and analyze complex problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences to design a smart, green and air pollution free urban community
	CO2 – PO3	3	Ability to design solutions for complex problems and design a smart, green and air pollution free urban community
	CO3 – PO2	3	Ability to identify, formulate, research literature and analyze complex problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences to design air quality monitoring and abatement systems
	CO3 – PO3	3	Ability to design solutions for complex problems and design air quality monitoring and abatement systems
	CO4 – PO2	3	Ability to identify, formulate, research literature and analyze complex problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences to analyze the root cause of air pollution and also to control such pollution
	CO4 – PO4	2	Able to conduct investigations of complex problems using research-based knowledge considering experimental design, data analysis and interpretation of data and information synthesis to provide valid conclusions in order to

			analyze the root cause of air pollution and also to control such pollution

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 • Continuous Assessment • Final Examination	 2 3
	Total	80

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			CT 1
	Class 1	Introduction	
	Class 2	Definition, components and effects of air pollution	
Week 2			
	Class 3	Sources, classification and effects of air pollutants	
	Class 4	Air pollution regulations: Air quality standard & Emission standard	
Week 3			
	Class 5	Pollution Indices, Mathematical problems	
	Class 6	Mathematical problems	
Week 4			
	Class 7	Formation, sources and effects of criteria pollutants	Mid Exam
	Class 8	Formation, sources and effects of criteria pollutants (cont.)	
Week 5			
	Class 9	Formation, sources and effects of criteria pollutants (cont.)	
	Class 10	Air quality scenario in Bangladesh	
Week 6			
	Class 11	Air quality scenario in Bangladesh (cont.)	
	Class 12	Atmospheric properties, Lapse rate and stability	
Week 7			
	Class 13	Atmospheric stability and plume behavior	
	Class 14	Mathematical problems related to atmospheric stability	

Week 8			
	Class 15	Atmospheric diffusion theories	CT 2
	Class 16	Point source Gaussian plume model	
Week 9			
	Class 17	Mathematical problems related to point source Gaussian plume model	
	Class 18	Mathematical problems related to point source Gaussian plume model (cont.)	
Week 10			
	Class 19	Line source Gaussian plume model	
	Class 20	Mathematical problems related to line source Gaussian plume model	
Week 11			
	Class 21	Air pollution control: Natural process & Engineering process	CT 3
	Class 22	Control measures for Industrial emission	
Week 12			
	Class 23	Control measures for Vehicular emission	
	Class 24	Example problems and analysis	
Week 13			
	Class 25	Climate change pattern	
	Class 26	Description on the responsible air pollutants	
Week 14			
	Class 27	Some overall mathematical problems	
	Class 28	Review of the total syllabus	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO2, CO3	
	Class Participation	5%	CO4	
	Mid Term	15%	CO2, CO3	
Final Exam		60%	CO1	C2, C3
			CO2	C3
			CO3	C3
			CO4	C4
Total Marks		100%		

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

REFERENCES 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.

REFERENCE SITE

http://classroom.google.com/...../.........

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 (Waste Water Engineering and Sanitation)	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
Students will learn about the processes in treatment of surface water, ground water and wastewater. They will learn designing the treatment plants, which will be helpful in their professional life.	
OBJECTIVE	
1. To learn about the treatment processes for surface and ground water to make it suitable for drinking water supply. 2. To learn about the waste water treatment processes. 3. To learn the design basic and treatment schemes of 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	PO – 2	C4		5	3, 4	R, V
CO2	Be able to **design** the materials and chemical dosing for treatment required in the treatment plants	PO – 3	C5		3	5	Asg, Q

**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)

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
CO1	Be able to **formulate** the treatment processes specific to surface water, ground water and wastewater		3										

CO2	Be able to **design** the materials and chemical dosing for treatment required in the treatment plants			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

Mapping	Corresponding Level of Matching	Justifications
CO1 – PO2	3	Able to identify, formulate, research literature and analyze the treatment processes specific to surface water, ground water and wastewater and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences
CO2– PO3	3	Able to design the materials and chemical dosing for treatment required in the treatment plants and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal and environmental concerns

TEACHING AND LEARNING STRATEGY

Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture • Experiment/Practical/ Tutorial/ Studio • Data analysis & Calculation • Student – Centered Learning	 10 10 7.5 --
Self- Directed Learning • Non-face-to-face learning • Report Writing • Revision of the previous lecture at home • Preparation for final examination	 -- 20 -- 7
Formal Assessment • Continuous Assessment • Final Examination/Quiz • Viva	 2.5 2 1
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

	Intended Topics to be Covered	Assessment
Week 1		
Class 1	Introduction	
Week 2		

	Class 2	Waste Stabilization Pond Design	
Week 3			
	Class 3	Waste Stabilization Pond Design (cont.)	
Week 4			
	Class 4	Septic Tank Design	
Week 5			
	Class 5	Septic Tank Design (cont.)	
Week 6			
	Class 6	Assessment (Viva)	Viva
Week 7			
	Class 7	Assessment (Mid Quiz)	Mid Quiz
Week 8			
	Class 8	Aerated Lagoon Design	
Week 9			
	Class 9	Aerated Lagoon Design (cont.)	
Week 10			
	Class 10	Activated Sludge process	
Week 11			
	Class 11	Activated Sludge process (cont.)	
Week 12			
	Class 12	Overall Review	
Week 13			
	Class 13	Assessment (Viva)	Viva
Week 14			
	Class 14	Assessment (Final Quiz)	Final Quiz

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Observation	5%	CO1, CO2	C2, C3
Report	15%	CO2	C3
Viva	10%	CO1	C1, C2
Quiz	70% (30+40)	CO1	C4
		CO2	C5
Total Marks	100%		

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

REFERENCES 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

REFERENCE SITE

http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 437	Credit Hour: 3.0
Course Title: Industrial Waste and Waste Water Treatment	Contact Hour: 3.0

PRE-REQUISITE

Chem 101, 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 also in professional life.

OBJECTIVE

1. To learn about the characteristics of various industrial wastes and waste waters.
2. To learn about the problems associated with poor management of industrial waste and wastewater.
3. To learn about the laws and regulations for industrial waste and wastewater treatment and disposal.

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to **understand** the industrial manufacturing process as well as generation of waste and wastewater.	PO – 1	C2	1		1, 3	T, F
CO2	Able to **assess** the adverse effect of waste and wastewater in terms of economic, public health, environment and sustainability.	PO – 7	C2	1, 3		1, 4	T, M, F
CO3	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	PO – 3	C4	1, 3		1, 5	Asg / CT, F

**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>

(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)

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
CO1	Be able to **understand** the industrial manufacturing process as well as generation of waste and wastewater.	3											
CO2	Be able to **assess** the adverse effect of waste and wastewater in terms of economic, public health, environment and sustainability.							2					
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			2									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING			
	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of science and engineering fundamentals has to be applied to the manufacturing of industrial product and waste water and solid waste generation.
	CO2 – PO7	2	Ability to assess the impacts of industrial waste and wastewater so that adverse environmental impacts could be minimized timely and effectively.
	CO3 – PO3	2	Ability to design and construct efficient and cost-effective ETP with appropriate consideration for public health and safety

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 final examination	12 15 46
	Formal Assessment • Continuous Assessment • Final Examination	2 3
	Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to Industrial Waste and Waste Water Treatment	
	Class 2	Waste water estimation	
	Class 3	Collection and transportation of Industrial sewage	
Week 2			
	Class 4	Industrial Waste Treatment I	
	Class 5	Characteristics of Industrial sewage	
	Class 6	Treatment and problems associated with industrial water	
Week 3			
	Class 7	Industrial Waste Treatment II	
	Class 8	Overview of waste reduction techniques in industries	
	Class 9	Manufacturing Process: Pulp and Paper Industry	
Week 4			
	Class 10	Manufacturing Process: Tannery Industry	CT 1
	Class 11	Pulp and Paper Industry waste	
	Class 12	Pulp and Paper Industry waste treatment I	
Week 5			
	Class 13	Tannery Waste	
	Class 14	Pulp and Paper Industry waste treatment II	
	Class 15	Manufacturing Process: Dairy Industry	
Week 6			
	Class 16	Tannery Waste Treatment I	
	Class 17	Dairy Industry waste	
	Class 18	Dairy Industry waste treatment	
Week 7			
	Class 19	Tannery Waste Treatment II	Mid Term Exam
	Class 20	Manufacturing Process: Oil Refinery	
	Class 21	Oil Refinery waste	

Week 8			
	Class 22	Manufacturing Process: Textile Mill Industry	
	Class 23	Textile Mill Industry waste	
	Class 24	Oil Refinery waste treatment	
Week 9			
	Class 25	Textile Mill Industry waste treatment I	
	Class 26	Textile Mill Industry waste treatment II	
	Class 27	Manufacturing Process: Petroleum Industry	
Week 10			
	Class 28	Manufacturing Process: Pharmaceutical Industry	CT 2
	Class 29	Pharmaceutical Industry waste	
	Class 30	Petroleum Industry waste	
Week 11			
	Class 31	Pharmaceutical Industry waste treatment I	
	Class 32	Pharmaceutical Industry waste treatment II	
	Class 33	Petroleum Industry waste treatment I	
Week 12			
	Class 34	Manufacturing Process: Sugar Mill Industry	
	Class 35	Sugar Mill Industry waste I	
	Class 36	Petroleum Industry waste treatment II	
Week 13			
	Class 37	Sugar Mill Industry waste treatment II	CT 3
	Class 38	Sugar Mill Industry waste treatment III	
	Class 39	Manufacturing Process: Corn Starch Industry	
Week 14			
	Class 40	Corn Starch Industry waste	
	Class 41	Corn Starch Industry waste treatment I	
	Class 42	Corn Starch Industry waste treatment II	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO4	
	Class Participation	5%	CO2	
	Mid Term	15%	CO2, CO3	
Final Exam		60%	CO1	C1, C2
			CO2	C2
			CO3	C3, C4
			CO4	C2, C3, C4
Total Marks		100%		

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

REFERENCES BOOKS

1. Industrial waste water 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 4. Industrial Wastewater Treatment - Wun Jern Ng, Imperial College Press
REFERENCE SITE
http://classroom.google.com/...../.........

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 of different services to be provided in a building, like water supply system, waste water and storm drainage system, water storage system, rainwater harvesting system, which will be helpful in their professional life.	
OBJECTIVE	
1. To learn about the major facilities/ services required for better living in buildings, especially in high rise buildings. 2. To design the necessary building services - water supply system, waste water and storm drainage system and water storage system. 3. To design alternative water supply system – rain water harvesting.	
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	PO – 2, 3	C4		3, 5	3, 4	R, V, Q
CO2	Be able to **design** underground and overhead water storage tanks	PO – 3	C5		3	5	R, V, Q
CO3	Be able to **design** rain water harvesting system	PO – 3	C5		3	5	R, V, Q

**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)

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
CO1	Be proficient to **analyze** and **design** the water supply, waste water and storm water drainage system		3	3									
CO2	Be able to **design** underground and overhead water storage tanks			3									
CO3	Be able to **design** rain water harvesting system			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING			
	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO2	3	Able to identify, formulate, research literature and analyze the water supply, waste water and storm water drainage system and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences
	CO1– PO3	3	Able to design the water supply, waste water and storm water drainage system that meet the specified needs with appropriate consideration for public health and safety, cultural, societal and environmental concerns
	CO2 – PO3	3	Able to design underground and overhead water storage tanks that meet the specified needs with appropriate consideration for public health and safety, cultural, societal and environmental concerns
	CO3 – PO3	3	able to design rain water harvesting system with appropriate consideration for public health and safety, cultural, societal and environmental concerns

TEACHING AND LEARNING STRATEGY		
	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Experiment/Practical/ Tutorial/ Studio • Data analysis & Calculation • Student – Centered Learning	 10 10 7.5 --
	Self- Directed Learning • Non-face-to-face learning • Report Writing • Revision of the previous lecture at home • Preparation for final examination	 -- 20 -- 7
	Formal Assessment • Continuous Assessment • Final Examination/Quiz • Viva	 2.5 2 1
	Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to Plumbing design	
Week 2			
	Class 2	Water supply (hot water and cold water) design of multi-storied buildings	
Week 3			
	Class 3	Water supply (hot water and cold water) design of multi-storied buildings (cont.)	
Week 4			
	Class 4	Sewerage design of multi-storied buildings	
Week 5			
	Class 5	Sewerage design of multi-storied buildings (cont.)	
Week 6			
	Class 6	Assessment (Viva)	Viva
Week 7			
	Class 7	Assessment (Mid Quiz)	Mid Quiz
Week 8			
	Class 8	Introduction to Rainwater Harvesting	
Week 9			
	Class 9	Planning and design of rainwater and ground water storage structures	
Week 10			
	Class 10	Planning and design of rainwater and ground water storage structures (cont.)	
Week 11			
	Class 11	Design of rainwater harvesting filters	

Week 12			
	Class 12	Maintenance and monitoring of rainwater harvesting system.	
Week 13			
	Class 13	Assessment (Viva)	Viva
Week 14			
	Class 14	Assessment (Final Quiz)	Final Quiz

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Observation	5%	CO1, CO2, CO3	C2, C3
Report	15%	CO1, CO2, CO3	C3
Viva	10%	CO1, CO2, CO3	C1, C2
Quiz	70% (30+40)	CO1	C4
		CO2	C5
		CO3	C5
Total Marks	100%		

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

REFERENCES BOOKS

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

REFERENCE SITE

http://classroom.google.com/...../.........

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

1. To understand the importance of natural resources conservation and management.
2. To learn about the use of energy in various emerging technologies.
3. To learn about the importance of using renewable energy.

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.	PO – 1	C2	1		1	T, F
CO2	Able to **understand** the importance of using renewable energy.	PO – 1	C2	1, 3		4	Asg/ CT, F
CO3	Able to **understand** and **apply** the concept of sustainable development in the use of energy in various emerging technologies.	PO – 7	C3	1, 3		1	F, Pr

**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>

(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)

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
CO1	Be able to **gain** knowledge about various natural resources.	2											
CO2	Be able to **understand** the	2											
CO3	Be able to **apply** the concept of sustainable development in the use of energy in various emerging technologies.							2					

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching).

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	2	Knowledge of classification and sources, extraction, depletion, protection and management of natural

			resources.
	CO2 – PO1	2	Ability to understand the development of various renewable energy and importance of using them.
	CO3 – PO7	2	Ability to apply the concept of sustainable development in the use of energy in various emerging technologies.

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 • Continuous Assessment • Final Examination	 2 3
	Total	80
TEACHING METHODOLOGY		
Lecture and Discussion, Problem Based Method		

COURSE SCHEDULE			
	Intended Topics to be Covered		Assessment
Week 1			
	Class 1	Introduction to Natural Resources	
	Class 2	Classification and sources of natural resources	
Week 2			
	Class 3	Extraction, depletion, protection and management of natural resources I	
	Class 4	Extraction, depletion, protection and management of natural resources II	
Week 3			
	Class 5	Overview, history of mainstream technologies	
	Class 6	Wind power	
Week 4			
	Class 7	Hydropower and hydroelectricity I	
	Class 8	Hydropower and hydroelectricity II	
Week 5			
	Class 9	Solar energy I	
	Class 10	Solar energy II	

Week 6			
	Class 11	Biomass and bio fuel I	CT 1
	Class 12	Biomass and bio fuel II	
Week 7			
	Class 13	Geothermal energy I	
	Class 14	Geothermal energy II	
Week 8			
	Class 15	Commercialization and growth of renewable energy	
	Class 16	Economic trends	
Week 9			
	Class 17	Wind power development I	Mid Term Exam
	Class 18	Wind power development II	
Week 10			
	Class 19	Photovoltaic development I	
	Class 20	Photovoltaic development II	
Week 11			
	Class 21	Photovoltaic power stations I	
	Class 22	Photovoltaic power stations II	
Week 12			
	Class 23	Bio fuel development I	CT 2
	Class 24	Bio fuel development II	
Week 13			
	Class 25	Geothermal development I	
	Class 26	Geothermal development II	
Week 14			
	Class 27	Emerging technologies of renewable energy I	
	Class 28	Emerging technologies of renewable energy II	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO3	
	Class Participation	5%	CO2	
	Mid Term	15%	CO2, CO3	
Final Exam		60%	CO1	C1, C2
			CO2	C2
			CO3	C3
Total Marks		100%		

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

REFERENCES 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
REFERENCE SITE
http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: GEEM 445 Course Title: Engineering Ethics and Professional Practices	Credit hours: 2.00 Contact hours: 2.00
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 proposal.	
OBJECTIVE	
1. To have a clear idea about different phases of a project. 2. To comprehend basic communication skill 3. To understand code of Ethics in engineering profession. 4. To gain knowledge on types of contracts, public procurements rules & regulations 5. Development of basic skills on preparation of development project proposal (DPP) 6. Development of skills on preparation of tender documents	
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: characteristic, life cycle, types of contracts and estimates. Project Proposals: preparation of various project and technical proposals according to planning commission's guidelines. PPR 2016: 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.	
COURSE OUTCOMES AND SKILL MAPPING	

No	COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)

.	(COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Ability to ascertain the essential elements required at different phases of a project.											√	
2	Learning code of ethics for engineers and will be ability to take an ethical decision after critical analysis of the situation.									√			
3.	Ability to make procurement of goods, works and services according to PPR 2016											√	

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to ascertain the essential elements required at different phases of a project.	11	C2	5		7	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Learning code of ethics for engineers and will be ability to take an ethical decision after critical analysis of the situation.	8	C2/C3	5		7	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to make procurement of goods, works and services according to PPR 2016	11	C2/C3	5		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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (2 hours/week x 14 weeks)	28
Guided Learning Tutorial/ Assignments (3 hours/week x 5 weeks)	10
Independent Learning Individual learning (1-hour lecture ≈ 1-hour	24

learning) Preparation for tests and examination	13
Assessment Continuous Assessment Final examination	 2 3
Total	80

TEACHING METHODOLOGY

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

TEACHING SCHEDULE

Week	Lectures	Topics	Assessments
1	1	Introduction to the code of ethics for engineers	CT/ Assignment-1
	2	Introduction to the code of ethics for engineers	
2	3	Introduction to the code of ethics for engineers	
	4	Introduction to the code of ethics for engineers	
3	5	Important vocabularies in ethics, Ethics in workplace	
	6	Important vocabularies in ethics, Ethics in workplace	
4	7	Important vocabularies in ethics, Ethics in workplace	CT/ Assignment-2
	8	Important vocabularies in ethics, Ethics in workplace	
5	9	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**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3, C4
Final Exam	60%	CO 1	C3, C4
		CO 2	C4
		CO 3	C2, C3
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

REFERENCE SITE

http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 461	Credit Hour: 3.0
Course Title: River Engineering and Flood Management	Contact Hour: 3.0
PRE-REQUISITE	
EWCE-263 (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 familiar with the design considerations of river training and bank protection works. Knowledge gained from this course will be useful in professional life.	
OBJECTIVE	
1. Demonstrate the understanding of the basics of river engineering and the morphological processes related to river. 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.	

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	PO – 1	C2	1		1, 3	T, F
CO2	Be proficient in **calculating and estimating** sediment distribution and sediment load of a river	PO – 2	C2	1, 3		1, 4	T, M, F
CO3	Be able to **apply** different engineering perceptions to estimating the scour depth	PO – 2	C3	1, 3		4, 7	CT, F
CO4	Be familiar with different bank protection and river training work and understand the dredging and navigation processes	PO – 2,3	C4	1, 3		1, 5	F, Pr

**Level of Bloom's Taxonomy:*

<u>C1 -</u> <u>C2 -</u> <u>C3 - Apply</u> <u>C4 -</u> <u>C5 -</u> <u>C6 -</u>

Remember	Understand		Analyze	Evaluate	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)

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
CO1	Be able to **explain** the relationships of river planforms with the river morphological parameters	3											
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		3										
CO4	Be familiar with different bank protection and river training work and understand the dredging and navigation processes		3	2									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to explain the relationships of river planforms with the river morphological parameters.

	CO2 – PO2	3	To be proficient in calculating and estimating sediment distribution and sediment load of a river would require the ability for problem formulation and analysis.
	CO3 – PO2	3	To apply different engineering perceptions for estimating the scour depth of a river would require the ability for problem formulation and analysis.
	CO4 – PO2	3	To be familiar with different bank protection and river training work and understand the dredging and navigation processes would require the ability for problem formulation and analysis
	CO4 – PO3	2	To be familiar with different bank protection and river training work and understand the dredging and navigation processes would require the ability to formulate and preliminarily design the relevant structure.

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 final examination	 9 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to river engineering and its importance – global and Bangladesh perspective	
	Class 2	Explanations on river classifications based on planforms, sediment load, substrate and flood types	
	Class 3	River planforms and their relationships with morphological parameters	
Week 2			

	Class 4	Hydraulic geometry characteristic of a river and their inter relationships	CT 1
	Class 5	Hydraulic geometry characteristic of a river and their inter relationships	
	Class 6	Sediment characteristics, sediment movement, initiation of motion	Mid Term Exam
Week 3			
	Class 7	Sediment characteristics, sediment movement, initiation of motion	
	Class 8	Sediment distribution – suspended load and bed load	
	Class 9	Sediment load computation – suspended load and bed load with examples, Case studies from local rivers	
Week 4			
	Class 10	Regimes of flow, bed forms, grain roughness and form roughness	
	Class 11	Regimes of flow, bed forms, grain roughness and form roughness	
	Class 12	Aggradation and degradation – Lane's equation and assessment of river equilibrium	
Week 5			
	Class 13	Aggradation and degradation – Lane's equation and assessment of river equilibrium	
	Class 14	River scour, processes, factors affecting scour and relationships with hydraulic and morphological parameters	
	Class 15	River scour, processes, factors affecting scour and relationships with hydraulic and morphological parameters	
Week 6			
	Class 16	Assessment of scour depth, live bed and clear water scour, complex pier, abutment scour	
	Class 17	Introduction to river training and bank protection works – groynes, guide bank, revetments and ripraps	
	Class 18	Design considerations of river training and bank protection works – groynes, guide bank, revetments and ripraps, case studies from local rivers	
Week 7			
	Class 19	Design considerations of river training and bank protection works – groynes, guide bank, revetments and ripraps, case studies from local rivers	
	Class 20	Navigation – importance, classification, morphological issues, navigation lock, maintenance and management issues	
	Class 21	Dredging – importance, capital dredging, design, maintenance and management issues, case studies from local rivers	
Week 8			
	Class 22	Introduction to flood and its causes	CT 2
	Class 23	Flood processes in rural areas	

	Class 24	Flood processes in urban areas	
Week 9			
	Class 25	Introduction to methods of flood management	
	Class 26	Structural measure: reservoirs	
	Class 27	Structural measure: reservoirs	
Week 10			
	Class 28	Structural measure: levees	
	Class 29	Structural measure: flood walls	
	Class 30	Structural measure: channel improvement	
Week 11			
	Class 31	Structural measure: interior drainage	
	Class 32	Structural measure: floodways	
	Class 33	Non-structural measure: land management	
Week 12			
	Class 34	Non-structural measure: flood proofing	CT 3
	Class 35	Non-structural measure: flood zoning	
	Class 36	Non-structural measure: flood hazard mapping	
Week 13			
	Class 37	Non-structural measure: flood forecasting and warning	
	Class 38	Flood risk	
	Class 39	Flood risk	
Week 14			
	Class 40	Flood damage	
	Class 41	Flood hazard	
	Class 42	Review class	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO4	
	Class Participation	5%	CO2	
	Mid Term	15%	CO2, CO3	
Final Exam		60%	CO1	C1, C2
			CO2	C2
			CO3	C3, C4
			CO4	C2, C3, C4
Total Marks		100%		

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

REFERENCES 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

REFERENCE SITE
http://classroom.google.com/...../.........

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 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	PO – 1	C2	1		1, 3	T, F
CO2	Be able to **solve** numerical approximation equations of open channel flow	PO – 2	C3	1, 3		1,2	T, M, F
CO3	Be able to **design** a river model	PO – 3,5	C6	1, 3		1,2,5	Asg/ CT, F
CO4	Be proficient to design a water distribution model for different practical applications	PO – 3,5	C6	1,3		1,2,5	

**Level of Bloom's Taxonomy:*

C2 - Understand	C3 - Apply	C4 - Analyze	C6 – Create	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)

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
CO1	Be able to explain the basic principles of modeling 1D and 1D/2D river flow	3											
CO2	Be able to solve numerical approximation equations of open channel flow	3											
CO3	Be able to design a river model	3				2							
CO4	Be proficient to design a water distribution model for different practical applications	3			2								

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to explain the basic principles of modeling 1D and 1D/2D river flow.
	CO2 – PO1	3	In order to solve numerical approximation equations of open channel flow, the knowledge of mathematics, natural science and engineering fundamentals is required.
	CO3 – PO1	3	To design a river model, the knowledge of mathematics, natural science and engineering fundamentals is required.

	CO3 – PO5	2	In order to design a river model, proper mathematical tool is need to be used.
	CO4 – PO1	3	Ability for problem formulation and analysis using mathematics, natural science and engineering fundamentals are required for capabilities are required to a water distribution model for different practical applications
	CO4 – PO4	2	Ability to design and construct efficient and cost-effective water distribution model is required, with research based knowledge.

TEACHING AND LEARNING STRATEGY		
	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 12 24 --
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 12 12 14
	Formal Assessment • Continuous Assessment • Final Examination	 24 1.5
	Total	99.5

TEACHING METHODOLOGY
Teaching and Learning Activities

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			Asg/T
	Class 1	Introduction to hydrodynamic modeling	
Week 2			
	Class 2	Definition and examples, review of mass balance, momentum and energy equations	
Week 3			
	Class 3	Different hydrodynamic models and their applications and limitations	
Week 4			
	Class 4	Different hydrodynamic models and their applications and limitations (Cont.)	Asg/T, M
Week 5			
	Class 5	Different hydrodynamic models and their applications and limitations (Cont.)	
Week 6			

	Class 6	Mid Term Quiz	
Week 7			
	Class 7	Introduction to modeling of water distribution systems	
Week 8			
	Class 8	Understanding the movement of drinking water constituents within distribution systems	PR,F
Week 9			
	Class 9	Understanding the movement of drinking water constituents within distribution systems (Cont.)	
Week 10			Asg,F
	Class 10	Optimizing operations of tanks and pumps	
Week 11			
	Class 11	Optimizing operations of tanks and Pumps(Cont.)	
Week 12			
	Class 12	Optimizing operations of tanks and Pumps(Cont.)	
Week 13			
	Class 13	Final Exam	
Week 14			
	Class 14	Project Submission	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test/Class Assessment/Assignments	20%	CO1, CO2, CO, CO4	
	Class Participation	5%	CO1, CO2, CO3,CO4	
	Mid Term	15%	CO1,CO2, CO3	
Final Exam		60%	CO1	C1
			CO2	C3
			CO4	C6
Total Marks		100%		

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

REFERENCES BOOKS

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

REFERENCE SITE

http://classroom.google.com/...../.........

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

EWCE26 (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 requirement and irrigation scheduling. 3. To be able to design surface and subsurface drainage systems. 4. To be familiar with irrigation and drainage structures, irrigation pump and their design criteria.
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	PO – 1	C2	1		1, 3	T, F
CO2	Be expert in **identifying/ preliminarily selecting/**	PO – 1,3	C2	1, 3		1, 4	T, M, F

	designing irrigation and drainage structures, flow measurement devices and irrigation pumps for efficient operation and management of irrigation and drainage projects						
CO3	Be able to **apply** engineering perceptions to improve the management of irrigation and irrigation efficiency	PO – 1,2	C3	1, 3		4, 7	T, F
CO4	Be proficient in assessing the drainage requirement of any crop and to design the necessary surface/subsurface drainage system	PO – 2,3	C4	1, 3		1, 5	T, F

**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)

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 drainage 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
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	3											
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		2									
CO3	Be able to **apply** engineering perceptions to improve the management of irrigation and irrigation efficiency	3	3										
CO4	Be proficient in **assessing** the drainage requirement of any crop and to design the necessary surface/subsurface drainage system		3	2									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to estimate the irrigation water requirement and crop water requirement

	CO2 – PO1	3	In order to identifying/ preliminarily selecting/designing irrigation and drainage structures, flow measurement devices and irrigation pumps for efficient operation and management of irrigation and drainage projects, the knowledge of mathematics, natural science and engineering fundamentals is required.
	CO2 – PO3	3	In order to identifying/ preliminarily selecting/designing irrigation and drainage structures, flow measurement devices and irrigation pumps for efficient operation and management of irrigation and drainage projects, the ability to design the system along with its component is required.
	CO3 – PO1	2	To be able to apply engineering perceptions to improve the management of irrigation and irrigation efficiency the knowledge of mathematics, natural science and engineering fundamentals has to be applied
	CO3 – PO2	3	To be able to apply engineering perceptions to improve the management of irrigation and irrigation efficiency requires ability for problem formulation and analysis
	CO4 – PO2	2	To be proficient in assessing the drainage requirement of any crop and to design the necessary surface/subsurface drainage system requires ability for problem formulation and analysis
	CO4 – PO3	2	To be proficient in assessing the drainage requirement of any crop and to design the necessary surface/subsurface drainage system requires the ability to design the system along with its components.

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 final examination	9 18 46	
	Formal Assessment • Continuous Assessment • Final Examination	2 3	
	Total	120	
TEACHING METHODOLOGY			
Lecture and Discussion, Problem Based Method			
COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to Irrigation and its importance – global and Bangladesh perspective	
	Class 2	History and development of irrigation – surface water and groundwater, crops, cropping pattern and intensity	
	Class 3	Soil physics in relation to irrigation and drainage, Soil and water relationships	
Week 2			
	Class 4	Soil moisture measurement – direct and indirect methods	CT 1
	Class 5	Soil water suction – Tensiometers, Soil characteristic curves and moisture holding capacity	
	Class 6	Soil - plant - water relationships, Evaporation, Transpiration and Evapotranspiration	Mid Term Exam
Week 3			
	Class 7	Crop water requirement (CWR), Factors affecting CWR	
	Class 8	CWR – measurement and estimation, CROPWAT	
	Class 9	Irrigation water requirement (IWR) and effective rainfall	
Week 4			
	Class 10	Example problems on CWR and IWR	
	Class 11	Irrigation water requirement (IWR) of rice, Seepage and percolation loss and land preparation requirement	
	Class 12	Irrigation Efficiency, concepts and classification	
Week 5			
	Class 13	Conveyance loss measurement – Ponding Method with examples	
	Class 14	Irrigation scheduling – concepts, methods and analysis	
	Class 15	Irrigation scheduling – analysis with examples	
Week 6			
	Class 16	Irrigation methods, classification, advantage and disadvantages	
	Class 17	Design of surface and subsurface irrigation with	

		examples	
	Class 18	Design of surface and subsurface irrigation with examples	
Week 7			
	Class 19	Design of surface and subsurface irrigation with examples	
	Class 20	Irrigation water quality and quality standards	
	Class 21	Soil and water salinity, remedial measures and leaching requirement with examples	
Week 8			
	Class 22	Irrigation and drainage structures, types and purposes	
	Class 23	Irrigation and drainage structures – design considerations and examples	CT 2
	Class 24	Flow measurement structures with examples	
Week 9			
	Class 25	Design of irrigation and drainage canals – erodible and lined canal design considerations	
	Class 26	Design of irrigation and drainage canals – best hydraulic section with examples	
	Class 27	Design of irrigation and drainage canals – Regime theory with examples	
Week 10			
	Class 28	Irrigation pumps, classification, components and operation	
	Class 29	Pump characteristic curves, BOP and efficiency with examples	
	Class 30	Pump in series and parallel, pump selection	
Week 11			
	Class 31	Irrigation management, concepts and importance	
	Class 32	Irrigation management – improving irrigation efficiency, water saving techniques in rice irrigation	
	Class 33	Irrigation management – people's participation	
Week 12			
	Class 34	Drainage of agricultural land – concepts, definitions and importance	
	Class 35	Drainage of agricultural land – surface and subsurface systems	CT 3
	Class 36	Surface drainage systems – deign considerations	
Week 13			
	Class 37	Subsurface drainage systems – deign considerations of steady state design	
	Class 38	Surface drainage systems – deign examples	
	Class 39	Subsurface drainage systems – deign examples	
Week 14			
	Class 40	Subsurface drainage systems – deign examples	
	Class 41	Irrigation and drainage systems of Bangladesh – present status and future potentials of major and minor irrigation	

	Class 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 (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO4	
	Class Participation	5%	CO2	
	Mid Term	15%	CO2, CO3	
Final Exam		60%	CO1	C1, C2
			CO2	C2
			CO3	C3, C4
			CO4	C2, C3, C4
Total Marks		100%		

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

REFERENCES BOOKS

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

REFERENCE SITE

http://classroom.google.com/...../.........

COURSE INFORMATION

Course Code: EWCE 464	Credit Hour: 1.5
Course Title: Advanced GIS and RS in Environment and Water Resources Engineering	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

The content of 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 OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **recognizes** the advance tools of Geographic Information Systems (GIS)	PO – 1	C1	1		1, 3	As g, M, F
CO2	Be able to **produce** contour maps, DEM from spot height geographic data using visualization concepts such as color theory and symbolization and GIS tools	PO – 1	C3	1, 3		1, 3	As sg/ T, M
CO3	Be able to **analyze** geospatial problems and/or research questions with the help of basic GIS analysis tools	PO – 2,5	C4	1, 3		1,2	As g, F
CO4	Be able to **create** Water shed delineation and generate 3D view of spatial data	PO – 5	C6	1, 3		1,2	PR , F

**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)

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
CO1	Be able to **recognizes** the advance tools of Geographic Information Systems (GIS)	3											

	CO2	Be able to **produce** contour maps, DEM from spot height geographic data using visualization concepts such as color theory and symbolization and GIS tools	2											
	CO3	Be able to **analyze** geospatial problems and/or research questions with the help of basic GIS analysis tools		3			3							
	CO4	Be able to **create** Water shed delineation and generate 3D view of spatial data					3							

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to locate geographic features and familiar with different type of geospatial data and data handling tools..
	CO2 – PO2	2	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to categorize and calculate attributes of geographic data to present them using visualization techniques.
	CO3 – PO2	3	To identify the existing geospatial problems to formulate solution techniques or answer research questions analyzing the different criteria/scenarios.
	CO3 – PO5	3	To select and apply appropriate GIS tools in geospatial problem solving and medium to large scale decision making.
	CO4 – PO5	3	Ability of creating watershed delineation basing on the tabular attribute information and raster information using appropriate tools.

TEACHING AND LEARNING STRATEGY

	Teaching and Learning Activities	Engagement (Hours)

	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 12 24 --
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 12 12 14
	Formal Assessment • Continuous Assessment • Final Examination	 24 1.5
	Total	99.5

TEACHING METHODOLOGY
Lecture, Tutorial, Practice and Class Assessment

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			Asg/T
	Class 1	Introduction to Raster data, Raster analysis	
Week 2			
	Class 2	DEM, Generating Contour and DEM from spot heights	
Week 3			
	Class 3	Introduction to Advanced GIS Tools, Watershed delineation using Hydrology tool,	
Week 4			
	Class 4	Introduction to Model Builder, Spatial Analyst	
Week 5			Asg/T,M
	Class 5	Geo statistical Analyst	
Week 6			
	Class 6	Mid Term Quiz	
Week 7			
	Class 7	3 D Analyst	
Week 8			
	Class 8	Introduction to RS techniques, satellite images, morphological changes using satellite images	PR,F
Week 9			
	Class 9	Remote Sensing Indices	
Week 10			Asg, F
	Class 10	Image Classification (Supervised, unsupervised)	
Week 11			
	Class 11	Overview of ERDAS Imagine software and its application	
Week 12			
	Class 12	Application of RS in national Geo-hazard	
Week 13			
	Class 13	Final Exam	
Week 14			
	Class 14	Project Submission	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test/Class Assessment/Assignments	20%	CO1, CO2, CO3	C1, C3,C4
	Class Participation	5%	CO1, CO2, CO3,CO4	C1, C3,C4,C6
	Mid Term	15%	CO1,CO2	C1, C3
Final Exam		60%	CO1	C1
			CO3	C4
			CO4	C6
Total Marks		100%		

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

REFERENCES 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.

REFERENCE SITE

https://www.esri.com/en-us/home

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

PRE-REQUISITE

EWCE-261 (Fluid Mechanics), EWCE-263 (Hydrology), EWCE-311(Structure Analysis and Design I) CE-315 (Design of Concrete Structures I), EWCE-343 (Geotechnical and Found 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 weir, barrage, dam as well as coastal structure such as sea wall, groin so on which will be helpful in their professional life in designing hydraulic structures.

OBJECTIVE

1. To gain knowledge on the basics of designing hydraulic structures.
2. To become skilled at the design of diversion head works.
3. To become proficient at the design of coastal structures.

COURSE OUTCOMES & GENERIC SKILLS

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

CO1	Be able to **recognizes** the hydraulics and water resources background in water structures design applications	PO – 1	C1	1		1	T, F
CO2	Be able to **explain** the basic principles and concepts of analysis and design of different hydraulic structures	PO – 1	C2	1,		3	T, M, F
CO3	To be able to **apply** basic design calculations of different hydraulic structures	PO – 3	C3	1, 3		4, 5	Asg/ CT, F

**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)

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 harbors, design considerations 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
CO1	Be able to **recognizes** the hydraulics and water resources background in water structures design applications	3											
CO2	Be able to **explain** the basic principles and concepts of analysis and design of different hydraulic structures	3											
CO3	To be able to **apply** basic design calculations of different hydraulic structures			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to recognize the hydraulics and water resources background in water structures design applications.

	CO2 – PO1	3	In order to explain the basic principles and concepts of analysis and design of different hydraulic structures, the knowledge of mathematics, natural science and engineering fundamentals is required.
	CO3 – PO3	3	To design different type of hydraulic structures knowledge of complex engineering problems is required

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 final examination	 9 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction	
	Class 2	Principles of design of hydraulic structures	
	Class 3	Types of hydraulic structures	
Week 2			
	Class 4	Theories of seepage	CT1
	Class 5	Bligh's theory	
	Class 6	Khosla's theory	
Week 3			
	Class 7	Percentage of pressure and exit gradient	
	Class 8	Diversion head works	
	Class 9	Protection works for surface and sub-surface flow	
Week 4			
	Class 10	Theory of Barrage	
	Class 11	Theory of weir	
	Class 12	Design of weir	
Week 5			
	Class 13	Theory of Barrage	
	Class 14	Design of Barrage	
	Class 15	Theory of dam	CT2
Week 6			

	Class 16	Design of dam	
	Class 17	Design of dam	
	Class 18	Theory and design of spillway	
Week 7			
	Class 19	Theory and design of energy dissipaters	Mid Term Exam
	Class 20	Introduction to reservoirs	
	Class 21	Capacity of Reservoir storage	
Week 8			
	Class 22	Basics of cross drainage works	
	Class 23	Design of cross drainage works	
	Class 24	Reviewing of abovementioned structures	
Week 9			
	Class 25	Introduction to coastal structures	
	Class 26	Structure types	
	Class 27	Structure types	
Week 10			
	Class 28	Design criteria of coastal structures	
	Class 29	Design criteria of coastal structures	
	Class 30	Material used in coastal structures	
Week 11			
	Class 31	Material used in coastal structures	
	Class 32	Introduction to marine Environment	
	Class 33	Deterioration due to marine environment	
Week 12			
	Class 34	Deterioration due to marine environment	
	Class 35	Repair of coastal structures	
	Class 36	Rehabilitation of coastal structures	
Week 13			
	Class 37	Planning of coastal structures	
	Class 38	Theory of shore protection works	
	Class 39	Theory of shore protection works	
Week 14			
	Class 40	Design considerations of shore protection works	CT 3
	Class 41	Design considerations of shore protection works	
	Class 42	Review of coastal structures	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO3	
	Class Participation	5%	CO2	C1
	Mid Term	15%	CO2, CO3	C1, C2
Final Exam		60%	CO1	C1, C2
			CO2	C2
			CO3	C3, C4
Total Marks		100%		

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

REFERENCES BOOKS

1. Hydraulic Structures – Garg 2. Open Channel Hydraulics – V. T. Chow
REFERENCE SITE
http://classroom.google.com/...../.........

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-263 (Hydrology), EWCE-311(Structure Analysis and Design I) CE-315 (Design of Concrete Structures I), EWCE-343 (Geotechnical and Found 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 bund which will be helpful in their professional life in designing hydraulic structures.	
OBJECTIVE	
1. To introduce different type of hydraulic structure. 2. To understand the basic design principle of hydraulic structure. 3. To impart knowledge and hands-on training on river training works.	
COURSE OUTCOMES & GENERIC SKILLS	

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **estimate** design storm, runoff volume and other hydrologic parameters for a catchment area	PO – 1	C2	1		1, 3	Asg, M, F
CO2	Be able to **compute** design loads, pressures and analyze stability of a hydraulic structure.	PO – 1	C3	1, 3		1, 3	Ass g/T, M

**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)

COURSE CONTENT
Types of hydraulic structures, principles of design, design of different types of hydraulic structures: regulators and Guide bund.
SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **estimate** design storm, runoff volume and other hydrologic parameters for a catchment area	3											
CO2	Be able to **compute** design loads, pressures and analyze stability of a hydraulic structure.	3				2							

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to **estimate** design storm, runoff volume and other hydrologic parameters for a catchment area
	CO2 – PO2	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to **compute** design loads, pressures and analyze stability of a hydraulic structure.
	CO2 – PO5		To **compute** design loads, pressures and analyze stability of a hydraulic structure, modern structural analysis tool SAP2000 is required.

TEACHING AND LEARNING STRATEGY

	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 12 24 --
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 12 12 14
	Formal Assessment • Continuous Assessment • Final Examination	 24 1.5

	Total		99.5
TEACHING METHODOLOGY			
Lecture, Tutorial, Practice and Class Assessment			
COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			Asg/T
	Class 1	Introduction	
Week 2			
	Class 2	Hydrologic design	
Week 3			
	Class 3	Selecting Glacis height	
Week 4			
	Class 4	Calculating Floor length	
Week 5			
	Class 5	Design of box conduit	
Week 6			
	Class 6	Design of box conduit	
Week 7			
	Class 7	Wing wall design	
Week 8			
	Class 8	Mid Term Exam	PR,F
Week 9			
	Class 9	Design of Floor/Apron	
Week 10			Asg/T
	Class 10	Design of retained wall	
Week 11			
	Class 11	Design of retained wall	
Week 12			
	Class 12	Design of guide bund	
Week 13			PR,F
	Class 13	Final Exam	
Week 14			Asg
	Class 14	Project Submission	
ASSESSMENT STRATEGY			

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test/Class Assessment/Assignments	20%	CO1, CO2,	C2, C3
	Class Participation	5%	CO1, CO2,	C2, C3
	Mid Term	15%	CO1,CO2	C2, C3
Final Exam		60%	CO1	C2
			CO2	C3
Total Marks		100%		

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

REFERENCES BOOKS

1. Hydraulic Structures – Garg. 2. Open Channel Hydraulics – Chow. 3. Principles of River Engineering – Garg. 4. Principles of River Engineering – Chang. 5. Principles of Water Resources Planning – Dr. Ainun Nishat (BUET)
REFERENCE SITE
https://www.esri.com/en-us/home

COURSE INFORMATION	
Course Code: EWCE 467	Credit Hour: 3.0
Course Title: Integrated Water Resource Management	Contact Hour: 3.0
PRE-REQUISITE	
EWCE 263 (Hydrology)	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
This course introduces students to Integrated Water Resources Management (IWRM). The purpose of this course is to give the students of water resources management a wider understanding of IWRM and the procedures and tools available for its implementation.	
OBJECTIVE	
1. To analyze the functions of natural and anthropogenic factors in water resources management. 2. To enhance student's capacity to plan water resource development. 3. To provide an understanding of principles of catchment management including policies, strategies and institutional arrangements for IWR 4. To be familiar with measures to protect water resources including laws and regulations governing water resources.	
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	PO – 1	C2	1		1, 3	T, F
CO2	Be able to **apply** engineering perceptions to explain policies, strategies and institutional arrangements for IWRM	PO –2	C3	1, 3		4, 7	T, F
CO3	Be proficient in **assessing** the role of natural and anthropogenic factors in water resources management	PO –3	C4	1, 3		1, 5	T, F

**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)

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
CO1	Be able to **explain** the basic principles and practice of IWRM	3											
CO2	Be able to **apply** engineering perceptions to explain policies, strategies and institutional arrangements for IWRM		3										
CO3	Be proficient in **assessing** the role of natural and anthropogenic factors in water resources management			2									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to explain the basic principles and practice of IWRM
	CO2 – PO2	3	In order to applying the engineering perceptions to explain policies, strategies and institutional arrangements for IWRM, the knowledge of mathematics, natural science and engineering fundamentals is required.
	CO3 – PO3	2	To be able to assess the role of natural and anthropogenic factors in water resources

			management the knowledge of mathematics, natural science and engineering fundamentals has to be applied

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 final examination	 9 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to IWRM	
	Class 2	IWRM Concept	
	Class 3	IWRM Principles	
Week 2			
	Class 4	Impacts of fragmented approach	CT 1
	Class 5	Importance of integration	
	Class 6	Implementing IWRM	
Week 3			
	Class 7	Implementing IWRM	
	Class 8	Planning fundamentals and processes	
	Class 9	Multi-criteria analysis	
Week 4			
	Class 10	Multi-criteria analysis	Mid Term Exam
	Class 11	Functions of water resources systems	
	Class 12	Introduction to Demand Management	
Week 5			
	Class 13	Demand Management	
	Class 14	Water management and sustainable development	
	Class 15	Sustainable development goals	
Week 6			
	Class 16	Sustainable development goal :6 and its target	
	Class 17	Water management and sustainable development : concepts and challenges	
	Class 18	Water management and sustainable development : concepts and challenges	

Week 7			
	Class 19	Case studies	
	Class 20	Case studies	
	Class 21	Review class	
Week 8			
	Class 22	Introduction and overview of WRS	
	Class 23	Use, Demand, Availability of water	CT 2
	Class 24	Use, Demand, Availability of water	
Week 9			
	Class 25	Introduction to Instream flow assessment	
	Class 26	Methods of Instream flow assessment	
	Class 27	Workout examples of Instream flow Assessment	
Week 10			
	Class 28	Water allocation	
	Class 29	Flood flow and low flow Analysis	
	Class 30	Workout examples of Flood flow and low flow Analysis	
Week 11			
	Class 31	Water Rights in terms of IWRM	
	Class 32	Water Rights: Economic view	
	Class 33	Waster use efficiency and Productivity	
Week 12			
	Class 34	Groundwater demand and use	CT 3
	Class 35	Groundwater Resources management	
	Class 36	Basin wise River Management	
Week 13			
	Class 37	Basin wise River Management	
	Class 38	Water Governance	
	Class 39	Stakeholder participation in IWRM	
Week 14			
	Class 40	Water Use and Conflicts	
	Class 41	Conflict Resolution Tools	
	Class 42	Review class	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO4	
	Class Participation	5%	CO2	
	Mid Term	15%	CO2, CO3	
Final Exam		60%	CO1	C1, C2
			CO2	C2
			CO3	C3, C4
			CO4	C2, C3, C4
Total Marks		100%		

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

REFERENCES BOOKS
1. McDonald, A.T and Kay, D (1998). Water Resources: Issues 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 Supply and Sanitation. McMillan.
REFERENCE SITE
http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 468	Credit Hour: 1.5
Course Title: Water Modelling Sessional	Contact Hour: 3.0
PRE-REQUISITE	
EWC 206 (GIS in Environmental and Water Resources Engineering), EWC 466 (Advanced GIS and RS in Environment and Water Resources Engineering)	
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 OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
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.	PO – 1	C2	1		1, 3	Asg/ Q, F

CO2	Able to **analyze** the water quality (e.g. contamination of groundwater, lakes and river due to point and non-point sources) problems using computer models.	PO – 2	C4	2		1, 4	Q, F

**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)

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
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.	3											
CO2	Able to **analyze** the water quality (e.g. contamination of groundwater, lakes and river due to point and non-point sources) problems using computer models.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

Mapping	Corresponding Level of Matching	Justifications
CO1 – PO1	3	Knowledge of mathematics, engineering fundamentals has to be applied to describe the basic concepts of hydrological modelling
CO2 – PO2	3	In order to identify the problem specific solutions using first principles of mathematics & engineering, knowledge of the water quality (e.g. contamination of groundwater, lakes and river) problems using computer models.is required.

TEACHING AND LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (Hours)
Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 14 28 --
Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 10 20 40
Formal Assessment • Continuous Assessment • Final Examination	 6 2
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method, Hands on Training

COURSE SCHEDULE		
	Intended Topics to be Covered	Assessment
Class 1	Introduction: Water modelling (Hydrological Model, Hydrodynamic Model, Water Quality Model)	
Class 2	Creating SCS Curve Number Grid using HEC-GeoHMS	
Class 3	HEC-HMS: Model Components (Control Specification Components, input Data Components)	
Class 4	Developing a HEC-HMS Model (Manual and Auto-calibration of Model)	CA 1
Class 5	Developing a HEC-HMS Model (Investigating Base-flow)	
Class 6	Developing a HEC-HMS Model (Routing a hydrograph using Muskingum Method)	
Class 7	Manual and Auto Calibration, Validation	CA 2
Class 8	Sensitivity analysis	
Class 9	Mid Quiz	
Class 10	Introduction into grid generation for flexible grids	
Class 11	Introduction on bathymetry interpolation	CA 3
Class 12	Set-up of hydrodynamic model and running this model	
Class 13	Introduction on post processing.	
Class 14	Final Quiz	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom’s Taxonomy
Report/ Assignment	30%	CO1, CO2	
Class Assessment	20%	CO2	
Mid Quiz	20%	CO1, CO2	
Observation	10%		
Final Quiz	20%	CO1	C2
		CO2	C4
Total Marks	100%		

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

REFERENCES 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
REFERENCE SITE
http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 469	Credit Hour: 3.0
Course Title: Mathematical Modelling in Water Resources Engineering	Contact Hour: 3.0
PRE-REQUISITE	
MATH 101 (Differential and Integral Calculus), EWCE 205 (Numerical Method), EWCE 204 (Computer Programming Sessional), EWCE 208 (Engineering Computations 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 OUTCOMES & GENERIC SKILLS	

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **solve** applications using a variety of problem solving strategies including geometric and algebraic techniques, linear and non-linear equations, statistical methods etc.	PO-1,PO-2	C2	1,2		2	Assg/T, M,F
CO2	Be able to **use** computational tools to develop mathematical models and evaluate their efficacy.	PO-5	C2	2,3		6	Asg/T,M, F

**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>

(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)

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
CO1	Be able to **solve** applications using a variety of problem solving strategies including geometric and algebraic techniques, linear and non-linear equations, statistical methods etc.	3	3										
CO2	Be able to **use** computational tools to develop mathematical models and evaluate their efficacy.					3							

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	To apply knowledge of mathematics, natural science and engineering fundamentals to represent water resources engineering problems using equations.
	CO1 – PO2	3	To identify, formulate, analyze and research literature on complex water resources engineering problems.
	CO2– PO5	3	Able to use appropriate modeling techniques and resources as prediction and decision support tools to solve water resources engineering problems.

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	 9 12 20
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	90

TEACHING METHODOLOGY

Lecture, Tutorials, Problem Based Method

COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	An Introduction to Mathematical Modeling	Asg, M
	Class 2	Modeling Scales and Representation	
Week 2			
	Class 3	Classification of Models	M
	Class 4	Stages of modeling	
Week 3			
	Class 5	Building Models: System Analysis	M
	Class 6	Choosing mathematical equations: Equations from the literature	
Week 4			
	Class 7	Solving equations: Dimensionless form	T,M
	Class 8	Solving equations: Asymptotic behavior	
Week 5			
	Class 9	Solving equations: Numerical Methods	
	Class 10	Solving equations: Numerical Methods	
Week 6			
	Class 11	Solving equations: Numerical Methods	Asg,F
	Class 12	Stability and convergence of numerical schemes,	
Week 7			
	Class 13	Schematization and boundary conditions	
	Class 14	Model calibration	
Week 8			
	Class 15	Sensitivity analysis	
	Class 16	Modelling model output	
Week 9			
	Class 17	Testing the assumptions, Model Structure	
	Class 18	Estimating model parameters	
Week 10			
	Class 19	Comparison of Models	
	Class 20	Using models: Predictions, Decision Support	
Week 11			

	Class 21	Practical application in modeling river flow	PR,F
	Class 22	Practical application in modeling groundwater flow	
Week 12			
	Class 23	Practical application of modeling coastal water	
	Class 24	Modeling advection-dispersion processes	
Week 13			
	Class 25	Mathematical modelling methods to analyze big data	
	Class 26	Mathematical modelling methods to analyze big data	
Week 14			
	Class 27	Project Submission	
	Class 28	Project Submission	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment /Project	20%	CO1,CO2	C2,C2
	Class Participation	5%	CO1,CO2	C2,C2
	Mid Term	15%	CO1	C2
Final Exam		60%	CO1	C2
			CO2	C2
Total Marks		100%		

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

REFERENCES 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.

REFERENCE SITE

https://www.google.com

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

The students will be acquainted with the key concepts, basic analysis and design techniques in Coastal Engineering.

OBJECTIVE

1. To understand and quantify ocean wave processes including wave generation, propagation, refraction, shoaling, diffraction, and breaking.
2. To learn ocean wave properties important to coastal engineering, including wave heights, speeds, induced water velocities, pressures, making appropriate approximations for deep and shallow waters.
3. To characterize tides and quantify basic coastal sediment transport processes and rates
4. To analyze coastal sites and to estimate hydrodynamic forces on simple structures.
5. Design simple shore protection structures
6. Identify different shoreline protection methods

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **understand** the basic nomenclature of coast and coastal zones, beach profiles, humans and the coastal zones, factors influencing coastal morphology and processes	PO-1	C2	1		1	Assg, M
CO2	Be able to **understand** the tides and coastal processes: characteristics of tides, theory behind tidal analysis and prediction, tidal flow measurement	PO-1	C2	1		1	Asg/ T,M
CO3	Be able to **understand** the coastal water level fluctuations: tides, storm surge, wind setup, basin oscillations, mechanics of wave motion: linear wave theory, wave kinematics, wind wave generation, wave refraction, diffraction and reflection	PO-2	C2	1		3	Assg/ T,M, F
CO4	Be able to **apply** the principles coastal processes, sediment transport, deltas and delta management plan, estuary and estuary control	PO-2	C3	1,3		5	Assg/ T,F
CO5	Be able to **apply** fundamental concepts in designing shore protection works and planning dock and harbours	PO-3	C3	5		4, 6	Assg/ T,F

**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)

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
CO1	Be able to **understand** the basic nomenclature of coast and coastal zones, beach profiles, humans and the coastal zones, factors influencing coastal morphology and processes	2											
CO2	Be able to **understand** the tides and coastal processes: characteristics of tides, theory behind tidal analysis and prediction, tidal flow measurement	3											
CO3	Be able to **understand** the coastal water level fluctuations: tides, storm surge, wind setup, basin oscillations, mechanics of wave motion: linear wave theory, wave kinematics, wind wave generation, wave refraction, diffraction and reflection		2										
CO4	Be able to **apply** the principles coastal processes, sediment transport, deltas and delta management plan, estuary and estuary control		2										
CO5	Be able to **apply** fundamental concepts in designing shore protection works and planning dock and harbours			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

Mapping	Corresponding Level of Matching	Justifications
CO1 – PO1	2	Apply the knowledge of mathematics, natural science and engineering fundamentals to understand the coastal features and morphology.
CO2 – PO1	3	Apply the knowledge of mathematics, natural science and engineering fundamentals to understand the tidal process.

	CO3– PO2	2	To understand the mechanics of wave and analyze the wave characteristics in coastal zone.
	CO4–PO2	2	To identify the coastal processes and to analyze the coastal sediment transport.
	CO5–PO3	3	Able to design shore protection works to minimize coastal erosion and flooding.

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 final examination	 15 22 36
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY
Lecture, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			Asg, M
	Class 1	Definitions and nomenclature of the coastal zones, Typical beach profiles	
	Class 2	Coastal diversity, human and coastal zones	
	Class 3	Factors influencing coastal morphology and processes	
Week 2			
	Class 4	Tides and coastal processes: Terms and Definitions, Characteristics of tides, Tide chart	T,M
	Class 5	Theory behind tidal analysis and prediction, Methods of tidal analysis and prediction	
	Class 6	Harmonic analysis of water level and current data, Non Harmonic analysis of water level and current data-Problem	
Week 3			
	Class 7	Definition of wave parameters, waves and its characteristics-concept	T,M
	Class 8	Linear wave theory: wave celerity, length, and period, the sinusoidal wave profile, local fluid velocities and accelerations-concept	
	Class 9	Water particle displacements, subsurface pressure, group velocity, wave energy and power-problem	

Week 4			
	Class 10	Wave propagation in shallow water, summary of linear wave theory- problem	
	Class 11	Changes in wave forms in coastal water	
	Class 12	Coastal zone processes, coastal erosion	
Week 5			
	Class 13	Coastal sediment transport, sediment transport theoretical models	M
	Class 14	Deltas, deltaic coasts, delta morphologies	
	Class 15	Effects of sea level rise and subsidence on deltas, saving the deltas: the human-delta relationship	
Week 6			
	Class 16	Delta management plan	F
	Class 17	Storm surge, wind stress	
	Class 18	Continental shelf, examples of surges-problem	
Week 7			
	Class 19	Tsunami: physical characteristics of tsunami, causes of tsunami	
	Class 20	Tsunami: mitigation of risks and hazards, prediction and early warnings	
	Class 21	Deep-ocean assessment and reporting of tsunamis	F
Week 8			
	Class 22	Hydrodynamics and Sediment Dynamics of Tidal Inlets	
	Class 23	Coastal-Offshore Ecosystem	
	Class 24	Physics of Shallow Estuaries and Bays	
Week 9			
	Class 25	Estuarine Cohesive Sediment Dynamics	
	Class 26	Offshore and Coastal Modelling	
	Class 27	Harbour layout: Types, port terms, site selection, features	
Week 10			Asg, F
	Class 28	Harbour planning and Layout	
	Class 29	Types and function of coastal structures	
	Class 30	Types and function of coastal structures	
Week 11			
	Class 31	Types and function of coastal structures	
	Class 32	Typical cross section and layouts	Asg,F
	Class 33	Typical cross section and layouts (Contd.)	
Week 12			
	Class 34	Typical cross section and layouts (Contd.)	
	Class 35	Main type of armor units	
	Class 36	Failure mode of typical structure types	
Week 13			
	Class 37	Design of shore protection works: introduction, purpose, applicability	
	Class 38	Functional design of coastal structures	
	Class 39	Design of coastal revetments	
Week 14			

	Class 40	Design of coastal sea walls	
	Class 41	Design of coastal sea bulkheads	
	Class 42	Environmental impacts of coastal structures	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1,CO2,CO3,CO5	C2,C2,C2,C3
	Class Participation	5%	CO2,CO3,CO5	C2,C2,C3
	Mid Term	15%	CO1,CO2,CO3	C2,C2,C2
Final Exam		60%	CO3	C2
			CO4	C3
			CO5	C3
Total Marks		100%		

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

REFERENCES 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.

REFERENCE SITE

https://www.google.com

COURSE INFORMATION	
Course Code: EWCE 475	Credit Hour: 2.0
Course Title: Urban Hydrology	Contact Hour: 2.0

PRE-REQUISITE

EWC 263 (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 environment.							
COURSE OUTCOMES & GENERIC SKILLS							
No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to **understand** the natural factors that regulate hydrologic processes in urban areas	PO – 1	C2	1		1, 3	Asg/T, F
CO2	Able to **estimate** and regulate the use of surface water and groundwater resources.	PO – 2	C2	2	2	1, 4	T, M, F
CO3	Able to **analyze** recent models on urban storm water management and sustainable urban drainage	PO – 2	C4	1		1, 3	Asg/T, F

**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)

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
CO1	Able to understand the natural factors that regulate hydrologic processes in urban areas	3											
CO2	Able to estimate and regulate the use of surface water and groundwater resources.		3										
CO3	Able to analyze recent models on urban stormwater management and sustainable urban drainage		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications

	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to describe the basic concepts of the natural factors that regulate hydrologic processes in urban areas
	CO2 – PO2	3	In order to identify the problem specific solutions using first principles of mathematics, natural sciences and engineering knowledge of surface water and groundwater resources is required.
	CO3 – PO2	3	Ability to analyze the recent models on urban stormwater management and sustainable urban drainage which will be required for engineering specialist knowledge.

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 10 32
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	80

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction: Hydrological Cycle	CT 1
	Class 2	Rainfall-runoff design methods	
Week 2			
	Class 3	Rainfall-runoff design methods	
	Class 4	Unit hydrograph: theory and urban hydrology applications	
Week 3			
	Class 5	Unit hydrograph: theory and urban hydrology applications	
	Class 6	Flood frequency: Introduction to frequency analysis and urban hydrology applications,	
Week 4			

	Class 7	Flood frequency: Introduction to frequency analysis and urban hydrology applications,	
	Class 8	Hydraulics: Revision of basic principles	
Week 5			Mid Term Exam
	Class 9	Rainfall: Data needs and analysis	
	Class 10	Storm weather: Quantities, estimation	
Week 6			
	Class 11	Storm weather: Design methods	
	Class 12	Wastewater: Quantities, estimation	
Week 7			
	Class 13	Wastewater: Design methods	
	Class 14	Combined sewers: Role, overflow	
Week 8			
	Class 15	Combined sewers: storage, urban pollution management	CT 2
	Class 16	Flow & quality models: Current and recent models using in practice	
Week 9			
	Class 17	Storm weather management	
	Class 18	Storm weather management	
Week 10			
	Class 19	Application for Watershed Scale Stormwater Management	
	Class 20	Application for Watershed Scale Stormwater Management	
Week 11			
	Class 21	Sustainable urban drainage: Source control techniques	
	Class 22	Sustainable urban drainage: Source control techniques	
Week 12			
	Class 23	Sustainable urban drainage: catchment models	CT 3
	Class 24	Sustainable urban drainage: catchment models	
Week 13			
	Class 25	Sustainable urban drainage: design approaches: small, medium, large.	
	Class 26	Sustainable urban drainage: design approaches: small, medium, large.	
Week 14			
	Class 27	Review of Urban Hydrology	
	Class 28	Review of Urban Hydrology	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy

Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO2.CO3	
	Class Participation	5%	CO1, CO3	
	Mid Term	15%	CO2	
Final Exam		60%	CO1	C2
			CO2	C2
			CO3	C4
Total Marks		100%		

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

REFERENCES 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.

REFERENCE SITE

http://classroom.google.com/...../.........

COURSE INFORMATION

Course Code: EWCE 477	Credit Hour: 2.0
Course Title: Climatology	Contact Hour: 2.0

PRE-REQUISITE

EWCE-103 (Physics), EWCE-105 (Environmental Chemistry), EWCE-261 (Fluid Mechanics), EWCE-263 (Hydrology)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/ RATIONALE

The course aims to provide the students with an integrated and advanced knowledge on the Earth's climate as well as its changes. Specific emphasis is given to the acquisition of a deep understanding of physical climate processes and principles and laws that govern climate.

OBJECTIVE

1. Introduction to meteorology and climatology.
2. 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.
3. Climatology topics include the interaction between the atmosphere and oceans over long time periods, climate classification, and the potential for climatic change.

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **learn** the definition and characteristics of climate as well as the differences and similarities of Climate science with other Atmospheric sciences, with emphasis to the definition and priorities of contemporary Climatology and climate	PO – 1	C2	1		1	T, F
CO2	Be up to date about the recent state of the Earth's climate and the means and methods of its observation and monitoring, emphasizing the nature and patterns of the changes that climate has undergone after the industrial revolution	PO – 4	C4	1		1, 4	T, M, F

**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

COURSE CONTENT

The global climate system: global heat and water balance, atmospheric and ocean circulation, interaction of ocean and atmospheric processes — annual cycle, monsoon circulation, tropical cyclones, ENSO (El Nino-Southern Oscillation) cycle, instrumentation and measurement of climate data, sources of climate data and information, climatic zones, climate models, climate variability and climate change, anthropogenic effects on climate- greenhouse warming, ozone layer depletion and sea level changes.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **learn** the definition and characteristics of climate as well as the differences and similarities of Climate science with other Atmospheric sciences, with emphasis to the definition and priorities of contemporary Climatology and climate	3											

CO2	Be up to date about the recent state of the Earth's climate and the means and methods of its observation and monitoring, emphasizing the nature and patterns of the changes that climate has undergone after the industrial revolution				1								

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals to **learn** the definition and characteristics of climate as well as the differences and similarities of Climate science with other Atmospheric sciences, with emphasis to the definition and priorities of contemporary Climatology and climate.
	CO2 – PO4	1	In order to interpret being up to date about the recent state of the Earth's climate and the means and methods of its observation and monitoring, emphasizing the nature and patterns of the changes that climate has undergone after the industrial revolution required.

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 • Continuous Assessment • Final Examination	 2 3
	Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction	

	Class 2	Greenhouse effect	CT 1
Week 2			
	Class 3	Global warming	
	Class 4	Climate	
Week 3			
	Class 5	Water vapor in a static atmospheric column	
	Class 6	Perceptible water	
Week 4			
	Class 7	El Niño-Southern Oscillation (ENSO)	Mid Exam
	Class 8	La Niña condition	
Week 5			
	Class 9	The Atmosphere and Climate	
	Class 10	Climate zones	
Week 6			
	Class 11	Climate of Bangladesh	
	Class 12	Layers of atmosphere	
Week 7			
	Class 13	Atmospheric circulation	
	Class 14	Thermohaline circulation	
Week 8			
	Class 15	Ozone and Ozone layer	CT 2
	Class 16	Ultraviolet radiation	
Week 9			
	Class 17	Ozone depletion	
	Class 18	Ozone hole	
Week 10			
	Class 19	Antarctic ozone hole and Arctic ozone hole	
	Class 20	Environmental effects of ozone depletion	
Week 11			
	Class 21	Air pollution and climate	CT 3
	Class 22	Influence of meteorology and topography on air pollution	
Week 12			
	Class 23	Smog and photochemical smog	
	Class 24	Acid Rain and effects of acid rain	
Week 13			
	Class 25	Hazards of Bangladesh	
	Class 26	Flood and Drought	
Week 14			
	Class 27	GCM and RCM	
	Class 28	Energy balance diagram	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1	
	Class Participation	5%	CO2	
	Mid Term	15%	CO1, CO2	

Final Exam	60%	CO1	C2
		CO2	C4
Total Marks	100%		

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

REFERENCES 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)

REFERENCE SITE

http://classroom.google.com/...../.........

COURSE INFORMATION	
Course Code: EWCE 479 Course Title: Groundwater Engineering	Contact hours: 2.00 Credit hours: 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

In this course students will be able to learn the basic of groundwater in hydrologic cycle and its occurrence, physical properties and principles of groundwater movement, groundwater and well hydraulics, groundwater resource evaluation, groundwater level sand 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.

COURSE OUTCOMES AND SKILL MAPPING													
No.	COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	**Understand** the basics of groundwater in hydrologic cycle and its occurrence, physical properties and principles of groundwater movement, groundwater and well hydraulics	√											
2	**Apply** knowledge regarding groundwater resource evaluation, pollution and contaminant transport, recharge of groundwater, saline water intrusion in aquifers, groundwater management		√										

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	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/ Assignment-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/ Assignment-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

TEACHING 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	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)

TEACHING SCHEDULE

Week	Lectures	Topics	Assessments
1	1	Introduction to Groundwater Engineering	CT/ Assignment-1
	2	Groundwater in hydrologic cycle and its occurrence	
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	
	8	**Class Test-1**	
5	9	Groundwater and well hydraulics	
	10	Groundwater and well hydraulics	
6	11	Groundwater and well hydraulics	Mid Term/ Assignment-2
	12	Groundwater resource evaluation	
7	13	Groundwater resource evaluation	
	14	Groundwater level sand environmental influences	
8	15	**Class Test-2**	
	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	**Class Test-3**	
	22	Recharge of groundwater	

12	23	Recharge of groundwater	CT/ Assignment-3
	24	Saline water intrusion in aquifers	
13	25	Saline water intrusion in aquifers	
	26	Groundwater management	
14	27	Groundwater management	
	28	**Review Class**	

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

REFERENCE BOOKS

1. "Groundwater Hydrology" by – Rushton
2. "Groundwater Engineering" by – Toad

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 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.	PO – 1	C2	1		1	T, M, F
CO2	Ability to **explain** environmental hazards, risk and vulnerability due to repeated occurrences of climatic extreme events/ disasters.	PO – 2	C2	1, 3		2	Asg/ T, M, F
CO3	Ability to **explain** the principle of resilience, adaptation, mitigation and preparedness in response to disasters.	PO – 4	C3	1, 3		1	F

**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)

COURSE CONTENT

Brief introduction to the science of climate change, trends in magnitude and frequency of climatic extremes, climate change impacts on natural hazards, strategies, methods and tools for integrated climate risk management.

History of natural disaster, Classification of natural disasters, sources of natural disaster, causes and effects of natural disasters. Nature, sources, causes and impacts of Environmental hazards experienced in Bangladesh. Vulnerability assessment, Disaster management, technologies for warning system, role of information in disaster, disaster preparedness.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Ability to **understand** the causes and effects of climate change to deal with disaster management.	3											
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.				3								

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching).

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Ability to **understand** the causes and effects of climate change to deal with disaster management.
	CO2 – PO2	3	Ability to **explain** environmental hazards, risk and vulnerability due to

			repeated occurrences of climatic extreme events/ disasters.
	CO3 – PO4	3	Ability to **explain** the principle of resilience, adaptation, mitigation and preparedness in response to disasters.

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	 9 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to weather, climate, climatic parameters	
	Class 2	Introduction to natural and climate induced extreme events, disasters	
Week 2			
	Class 3	Concept on anomalies of climate events	
	Class 4	Trend analysis on magnitude and frequency of climatic extremes/ disasters	
Week 3			
	Class 5	Concept on hazards, risk and vulnerability	CT 1
	Class 6	Relationship between hazard, probability and risk	
Week 4			
	Class 7	Analysis on climate risk and vulnerability	
	Class 8	Case studies on Environmental hazards	
Week 5			
	Class 9	Sensitivity to environmental hazards	Mid Term
	Class 10	Climate change impacts on natural hazards	
Week 6			
	Class 11	Nature, sources, causes and impacts of Environmental hazards experienced in Bangladesh	
	Class 12	Dimensions of Disaster: scale, vulnerability, Disaster trends	

Week 7			
	Class 13	History of natural disaster, Classification of natural disasters	
	Class 14	Causes and impacts of natural disasters	
Week 8			
	Class 15	Vulnerability analysis: hazard assessment, resource requirement, defining an acceptable level of risk	
	Class 16	Risk assessment: nature and assessment of risks	
Week 9			
	Class 17	Risk perception and management	
	Class 18	Strategies and policy for integrated climate risk management	
Week 10			
	Class 19	Methods and tools used for integrated climate risk management	
	Class 20	Minimizing disaster loss: Environmental control, hazard resistance, preparedness with prior information, forecasting and warning technologies, land use planning	
Week 11			
	Class 21	Disaster mitigation measures: non-structural and structural mitigation	CT 2
	Class 22	Case studies for experience and reduction of hazards: Seismic hazards – earthquakes, volcanoes	
Week 12			
	Class 23	Disaster management for mass movement hazards: landslides, avalanches	
	Class 24	Disaster management for atmospheric hazards: cyclones, storms, tornadoes	
Week 13			
	Class 25	Disaster management for hydrological hazards: flood, drought	
	Class 26	Disaster management for technological hazards: industrial accidents, oil spills	
Week 14			
	Class 27	Early warning systems for disaster preparedness in Bangladesh	
	Class 28	Disaster management practices in Bangladesh	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO2	C2
	Class Participation	5%		
	Mid Term	15%		
Final Exam		60%	CO1	C2
			CO2	C2
			CO3	C3

Total Marks	100%		

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

REFERENCES 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.
REFERENCE SITE
http://classroom.google.com/...../.........

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 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.	PO – 1, 2	C3, C4	1,3		2, 3	T, F
CO2	Be able to **design** plumbing system for water supply, sewage and storm sewage, ventilation, fire-fighting, air conditioning.	PO – 3	C5	4, 5		5, 6	M, F

CO3	Be proficient to **understand** the design basics for lift installation, generator.	PO – 1	C2	1		1, 2	Asg/ CT, M, F
CO4	Be expert in **designing** rain water harvesting system and other electrical and mechanical installations in buildings.	PO – 3	C5	3, 5		5, 6	F, Pr

**Level of Bloom's Taxonomy:*

<u>C1 - Remember</u> <u>C2 – Understand</u> <u>C3 – Apply C6 - Create</u> <u>C4 - Analyze</u> <u>C5 - Evaluate</u> <u>C6 - Create</u>

(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)

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
CO1	Be skillful to **estimate** water requirement and **use** for various purposes in different types of building usage.	3	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	3											
CO4	Be expert in **designing** rain water harvesting system and other electrical and mechanical installations in buildings.			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to estimate water requirement.

	CO1– PO2	2	Able to identify and formulate the use for various purposes in different types of building usage
	CO2 – PO3	3	Ability to design plumbing system for water supply, sewage and storm sewage, ventilation, fire-fighting, air conditioning that meet the specified needs with appropriate consideration for public health and safety, cultural, societal and environmental concerns
	CO3 – PO1	3	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to understand the design basics for lift installation, generator
	CO4 – PO3	3	Ability to design rain water harvesting system and other electrical and mechanical installations in buildings that meet the specified needs with appropriate consideration for public health and safety, cultural, societal and environmental concerns

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 • Continuous Assessment • Final Examination	 2 3
	Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to plumbing	
	Class 2	Water requirements in a building	CT 1
Week 2			
	Class 3	Water requirements in a building (cont.)	
	Class 4	Water supply and distribution in buildings	
Week 3			
	Class 5	Water supply and distribution in buildings (cont.)	

	Class 6	Plumbing of multistoried buildings	
Week 4			Mid Exam
	Class 7	Design and construction of septic tanks	
	Class 8	Design and construction of soak wells	
Week 5			
	Class 9	Design and construction of subsurface drain fields	
	Class 10	Design and construction of septic tanks, soak wells and subsurface drain fields (cont.)	
Week 6			
	Class 11	House wiring	CT 2
	Class 12	House wiring (cont.)	
Week 7			
	Class 13	Air conditioning (HVAC)	
	Class 14	Air conditioning (HVAC) (cont.)	
Week 8			
	Class 15	Lift installation	
	Class 16	Lift installation (cont.)	
Week 9			
	Class 17	Air handling unit, generator and other electrical and mechanical installations in building	
	Class 18	Air handling unit, generator and other electrical and mechanical installations in building (cont.)	
Week 10			CT 3
	Class 19	Rain water harvesting unit	
	Class 20	Rain water harvesting unit (cont.)	
Week 11			
	Class 21	Solar panel	
	Class 22	Solar panel (cont.)	
Week 12			
	Class 23	Fire-fighting	
	Class 24	Fire-fighting (cont.)	
Week 13			
	Class 25	Fire escape	
	Class 26	Fire escape (cont.)	
Week 14			
	Class 27	Review of the total syllabus	
	Class 28	Review of the total syllabus (cont.)	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO3	
	Class Participation	5%	CO3	
	Mid Term	15%	CO2	
Final Exam		60%	CO1	C3, C5
			CO2	C5
			CO3	C2

		CO4	C5
Total Marks	100%		

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

REFERENCES BOOKS
1. Building services engineering – David V. Chadderton, 6th Ed. 2. Building services handbook – Roger Greeno, 7th Ed, Fred Hall
REFERENCE SITE
http://classroom.google.com/...../.........

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	
1. To make the students understand about requirements and steps of EMS 2. To familiarize the students with various EMS models 3. To learn about EMS standards, techniques and process tools	
COURSE OUTCOMES & GENERIC SKILLS	

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to **understand** about requirements, standards and steps of EMS.	PO – 1	C2	1		1	T, F
CO2	Able to **use** various EMS models.	PO – 2	C4	1, 3		4	Asg/ CT, F
CO3	Able to **understand** and **apply** the concept of sustainable development in the use of EMS technologies.	PO – 7	C3	1, 3		1	F, Pr

**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)

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
CO1	Be able to **understand** about requirements, standards and steps of EMS.	2											
CO2	Be able to **use** various EMS models.		2										
CO3	Be able to **understand** and **apply** the concept of sustainable development in the use of EMS technologies.							2					

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	2	Knowledge of standards, requirements and processing tools of EMS.
	CO2 – PO2	2	Ability to use various EMS models.
	CO3 – PO7	2	Ability to apply the concept of sustainable development in the use of EMS technologies.

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 • Continuous Assessment • Final Examination	 2 3
	Total	80
TEACHING METHODOLOGY		
Lecture and Discussion, Problem Based Method		
COURSE SCHEDULE		

		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to Management Systems	
	Class 2	Requirements of EMS	
Week 2			
	Class 3	Elements of EMS I	
	Class 4	Elements of EMS II	
Week 3			
	Class 5	The ISO 14001 EMS Model I	
	Class 6	The ISO 14001 EMS Model II	
Week 4			
	Class 7	Scope of ISO 14001 I	
	Class 8	Applicability of ISO 14001	
Week 5			
	Class 9	Scope of ISO 14004 II	
	Class 10	Applicability of ISO 14001	
Week 6			
	Class 11	Purpose, Scope and Benefits of EMS Standards I	CT 1
	Class 12	Purpose, Scope and Benefits of EMS Standards II	
Week 7			
	Class 13	Purpose, Scope and Benefits of EMS Standards III	
	Class 14	Purpose, Scope and Benefits of EMS Standards IV	
Week 8			
	Class 15	EMS Implementation I	
	Class 16	EMS Implementation II	
Week 9			
	Class 17	General Requirements of ISO 14001 I	Mid Term Exam
	Class 18	General Requirements of ISO 14001 II	
Week 10			
	Class 19	EMS Tools I	
	Class 20	EMS Tools II	
Week 11			
	Class 21	EMS Techniques I	
	Class 22	EMS Techniques II	
Week 12			
	Class 23	Housekeeping I	CT 2
	Class 24	Housekeeping II	
Week 13			
	Class 25	Practical applications of EMS I	
	Class 26	Practical applications of EMS II	

Week 14			
	Class 27	Practical applications of EMS I	
	Class 28	Practical applications of EMS II	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO4	
	Class Participation	5%	CO2	
	Mid Term	15%	CO2, CO3	
Final Exam		60%	CO1	C1, C2
			CO2	C2
			CO3	C3, C4
Total Marks		100%		

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

REFERENCES 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

REFERENCE SITE

http://classroom.google.com/...../.........

5.2. Courses Offered by Department of Science and Humanities

COURSE INFORMATION	
Course Code: CHEM-101 Course Title: Fundamentals of Chemistry	Contact Hours: 3.00 Credit Hours: 3.00

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 OUTCOMES & GENERIC SKILLS

No.	Course Outcomes	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **define** the different parameter and concepts regarding atomic structure, periodic table, chemical bonding, acids and bases.	1	C1			1	T, F
CO2	Be able to **apply** different theory on chemical bonding and hybridization to **evaluate** structure of molecules.	1	C3, C5			1,2	T, F, ASG
CO3	Be able to classify hydrocarbons and **explain** the mechanism of selective organic reactions.	1	C2			1,2	T, F, ASG
CO4	**Explain** chemical equilibrium, thermo-chemistry, chemical and ionic equilibria, electro-chemical cells.	1	C2			1,2	ASG ,Mid Term Exam, F

**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>

(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)

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

Basic Concepts of Organic Chemistry: History, Physical and chemical properties, Classification

Hydrocarbon: Chemistry of hydrocarbon, Nomenclature, Properties

Selective Organic Reactions: Oxidation-reduction, Substitution, Addition, Polymerization, Alkylation reactions

Acids-Bases/Buffer Solution: Different concepts of acids-bases, Buffer solution, Mechanism of buffer solution, Henderson-Hasselbalch equation, Water chemistry and pH of water

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
Phase Rule: Basic terms and phase rule derivation, Phase diagram of water and carbon dioxide
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

CO-PO MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **define** the different parameter and concepts regarding atomic structure, periodic table, chemical bonding, acids and bases.	1											
CO2	Be able to **apply** different theory on chemical bonding and hybridization to evaluate structure of molecules.	2											
CO3	Be able to **classify** hydrocarbon and **explain** the mechanism of selective organic reactions.	2											
CO4	**Explain** chemical equilibrium, thermo-chemistry, chemical and ionic equilibria, electro-chemical cells.	2											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING 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	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Week 1	Atomic Structure	CT
Class 1	Concepts of atomic structure, Different atom models	CT-1
Class 2	Concepts of atomic structure, Different atom models	
Class 3	Quantum numbers, Electronic configuration	
Week 2	**Atomic Structure/Periodic Table**	
Class 4	Hydrogen spectral lines, Heisenberg's uncertainty principle	
Class 5	Classification of elements according to electronic configurations	
Class 6	Periodic classification of elements	
Week 3	**Periodic Table/Chemical Bonding**	
Class 7	Periodic properties of elements, Properties and uses of noble gases	
Class 8	Alkali metals: Chemical properties and uses	
Class 9	Chemical bonding (types, properties, Lewis theory, VBT)	
Week 4	**Chemical Bonding**	CT-2
Class 10	Molecular orbital theory (MOT)	
Class 11	Molecular orbital theory (MOT)	
Class 12	Hybridization and shapes of molecules	
Week 5	**Chemical Bonding/Organic Chemistry**	
Class 13	Hybridization and shapes of molecules	
Class 14	Hybridization and shapes of molecules	
Class 15	Basic concepts of organic chemistry: History, Physical & chemical properties, Classification	
Week 6	**Organic Chemistry**	
Class 16	Chemistry of hydrocarbon, Nomenclature, Properties	
Class 17	Selective organic reactions: Oxidation-reduction, Substitution	
Class 18	Selective organic reactions: Addition, Polymerization, Alkylation	
Week 7	**Acids-Bases**	CT-3/Mid Term
Class 19	Different concepts of acids-bases	
Class 20	Buffer solution, Mechanism of buffer solution	
Class 21	Henderson-Hasselbalch equation	
Week 8	**Acids-Bases/Solutions**	
Class 22	Water chemistry and pH of water	
Class 23	Solutions and their classification, Unit expressing concentration	
Class 24	Effect of temperature and pressure on solubility, Validity and limitations of Henry’s law	
Week 9	**Solutions/Thermochemistry**	
Class 25	Colligative properties and dilute solutions, Raoult’s law, deviation from Raoult’s law, Elevation of boiling point	
Class 26	Freezing point depression, Van’t Hoff’s law of osmotic pressure	
Class 27	Thermochemistry: Laws of thermochemistry, Enthalpy	
Week 10	**Thermochemistry/Electrochemistry**	
Class 28	Hess's law, Kirchoff’s equations	
Class 29	Heat of formation, Heat of neutralization, Heat of reaction	
Class 30	Electrolytic conduction and its mechanism	

Week 11	**Electrochemistry**	
Class 31	Faraday's law, Kohlrausch Law, Debye-Huckel-Onsagar theory	
Class 32	Conductrometric titrations	
Class 33	Different types of cells	
Week 12	**Chemical Equilibrium**	
Class 34	Reversible reactions, Characteristics of chemical equilibrium, Law of mass action, Equilibrium constant, Units of equilibrium constant	CT-4
Class 35	Relation between Kp & Kc,Van't Hoff's reaction isotherm	
Class 36	Free energy and its significance Heterogeneous equilibrium, Le Chatelier's principle	
Week 13	**Phase Rule/Chemical Kinetics**	
Class 37	Phase Rule: Basic terms and phase rule derivation	
Class 38	Phase Diagram of water and carbon dioxide	
Class 39	Pseudo and zero order reaction, Half-life	
Week 14	**Chemical Kinetics**	
Class 40	Determination and factors affecting the rate of a reaction	
Class 41	First order reaction, Second order reaction	
Class 42	Collision theory, Transition state theory	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment	20%	CO1	C1
			CO2	C3, C5
			CO3	C2
			CO4	C2
	Class Performance	5%	CO3	C2
			CO4	C2
	Mid term	15%	CO4	C2
Final Exam		60%	CO1	C1
			CO2	C3, C5
			CO3	C2
			CO4	C2
Total Marks		100%		

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

TEXT AND REFERENCE BOOKS

1. Modern Inorganic Chemistry – S. Z. Haider
2. Concise Inorganic Chemistry – J. D. Lee
3. A Textbook of Organic Chemistry – Arun Bahl And B. S. Bahl
4. Organic Chemistry – Morrison and Boyd
5. Principles of Physical Chemistry – Haque and Nawab
6. Essentials of Physical Chemistry – Bahl and Tuli
7. Physical Chemistry – Atkins

<table>
<tr><td colspan="8">COURSE INFORMATION</td></tr>
<tr><td colspan="4">Course Code: CHEM 102
Course Title: Chemistry Sessional</td><td colspan="4">Contact Hours: 3.00
Credit Hours: 1.50</td></tr>
<tr><td colspan="8">PRE-REQUISITE</td></tr>
<tr><td colspan="8">Course Code: N/A</td></tr>
<tr><td colspan="8">CURRICULUM STRUCTURE</td></tr>
<tr><td colspan="8">Outcome Based Education (OBE)</td></tr>
<tr><td colspan="8">SYNOPSIS/RATIONALE</td></tr>
<tr><td colspan="8">To implement the basic concepts of inorganic and physical chemistry in a laboratory environment.</td></tr>
<tr><td colspan="8">OBJECTIVE</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">LEARNING OUTCOMES & GENERIC SKILLS</td></tr>
<tr><td>No.</td><td>Course Outcomes</td><td>Corresponding PO</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>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.</td><td>1</td><td>P1</td><td></td><td></td><td>1,2</td><td>R,Q,T</td></tr>
<tr><td>CO2</td><td>Be able to explain the different phenomena and perform experimentation regarding iodimetric and iodometric method, complexometric titration etc.</td><td>1,5,10</td><td>P2,P3, P4,P5</td><td></td><td></td><td>1,2</td><td>R,Q,T</td></tr>
<tr><td>CO3</td><td>Be able to measure zinc, ferrous content in water sample by using various titrimetric methods.</td><td>1,5,10</td><td>P3,P4,P5</td><td></td><td></td><td>1,2</td><td>R,Q,T , Pr</td></tr>
<tr><td colspan="8">*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>

(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,</td></tr>
</table>

F – Final Exam)

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.

CO-PO MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
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 etc.	2				2				3			
CO3	Be able to **measure** zinc, ferrous content in water sample by using various titrimetric methods.	2				2				3			

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	12
Experiment	30
Self-Directed Learning	
Preparation of Lab Reports	24
Preparation of Lab-test	10
Preparation of Quiz	10
Preparation of Presentation	6
Formal Assessment	
Continuous Assessment	10
Final Quiz	1
Total	103

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE

Class/Week	Intended topics to be covered
Class 1	Introduction
Class 2	Standardization of Sodium Hydroxide (NaOH) Solution with Standard Oxalic Acid dihydrate ($C_2H_2O_4.2H_2$ O) Solution.
Class 3	Standardization of Hydrochloric Acid (HCl) Solution with Standard Sodium Hydroxide (NaOH) Solution.
Class 4	Standardization of Hydrochloric Acid (HCl) Solution with Standard Sodium Carbonate (Na_2 CO_3) Solution.
Class 5	Determination of Calcium (Ca) Content in a Calcium Chloride dihydrate ($CaCl_2.2H_2$ O) Solution with Standard Di-Sodium Ethylene DiammineTetraAceticAcid (Na_2-EDTA) Solution.
Class 6	Standardization of Sodium ThiosulphatePentahydrate ($Na_2S_2O_3.5H_2$ O) Solution with Standard Potassium Dichromate ($K_2Cr_2O_7$) Solution.
Class 7	Estimation of Copper (Cu) Content in a Copper SulphatePentahydrate ($CuSO_4$ $.5H_2$ O) (Blue Vitriol) Solutions by Iodometric Method with Standard Sodium ThiosulphatePentahydrate ($Na_2S_2O_3$ $.5H_2$ O) Solution.
Class 8	Standardization of Potassium Permanganate ($KMnO_4$) Solution with Standard Oxalic Acid dihydrate (C_2 H_2 O_4 $.2H_2$ O) Solution.
Class 9	Determination of Ferrous (Fe) Content in a Ammonium Ferrous Sulphate (Mohr`s Salt) [$FeSO_4.(NH_4$ $)2SO_4.6H_2O$] Solution with Standard Potassium Permanganate ($KMnO_4$)) Solution.
Class 10	Determination of Zinc (Zn) Content in a Zinc SulphateHeptahydrate ($ZnSO_4.7H_2O$) Solution with Standard Di-Sodium EthyleneDiamineTetraAcetic acid (Na_2-EDTA) (Na_2-EDTA) Solution by using Eriochrome black T indicator.
Class 11	Practice Lab
Class 12	Lab Test
Class 13	Quiz Test
Class 14	Viva

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Lab participation and Report	15%	CO 1	P1
			CO 2	P2,P3,P4,P5
			CO 3	P3,P4,P5
	Labtest-1, Labtest-1, Labtest-2Labtest-2	25%	CO 1	P1
			CO 2	P2,P3,P4,P5
			CO 3	P3,P4,P5

	Presentation	20%	CO3	P3,P4,P5
Lab Quiz		30%	CO 1	P1
			CO 2	P2,P3,P4,P5
			CO 3	P3,P4,P5
Total Marks		100%		

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

TEXT AND 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 Chemistry

COURSE INFORMATION

Course Code: PHY 101 Course Title: Waves and Oscillation, Optics and Modern Physics	Credit Hours: 3.00 Contact Hours: 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course is the basic physics in the field of Waves and Oscillations, Optics and Modern physics. The course will be emphasized the basic concepts, theories and solve quantitative problems which can be applicable in a wide spectrum of engineering Disciplines.

OBJECTIVES

1. To define the different parameter and concepts of Waves and Oscillations, Optics and Modern physics.
2. To explain the basic theories of Waves and Oscillations, Optics and Modern physics.
3. To solve numerical problems regarding Waves and Oscillations, Optics and Modern physics.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome	Corresponding POs	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **Define** different basic parameters in the field of Waves and Oscillations, Optics and Modern physics such as periodic motion, simple harmonic motion, undamped oscillations, interference, diffraction, polarization and prism, photoelectric effect, Compton effect, matter wave,	PO-1	C1	-	-	K1	T, F, MT

	atomic model, radioactive decay, fusion, fission etc.						
CO2	Be capable to **Explain** different basic theories in the field of Waves and Oscillations, Optics and Modern physics such as the wave motion for different systems along with energy, different formula for interference, diffraction, polarization special theory of relativity, Compton theory, nuclear transformation, and nuclear reaction etc.	PO-1	C1	-	-	K1	F, MT
CO3	Be skilled to **Solve** quantitative problems in the field of Waves and Oscillations, Optics and Modern physics such as energy of wave motion, wavelength, diffraction pattern, relativistic energy, photon energy, Compton shift, nuclear binding energy etc.	PO-1	C2	-	-	K2	T, F, MT, ASG

**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>

(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)

COURSE CONTENT

Waves and Oscillations: Simple Harmonic Motion (SHM) and its properties, Differential equation of a SHM and its solution, total energy of a body executing SHM, average kinetic and potential energy of a body executing SHM, LC oscillatory circuit, Pendulum: simple, compound and torsional pendulum, spring-mass system, two body oscillation and reduced mass, damped harmonic motion and its different condition, forced oscillation and its different condition, resonance, equation of a progressive wave, differential equation of a progressive wave, energy density of wave motion, average kinetic and potential energy of a body executing SHM, Stationary wave

Optics: Lens, equivalent lens and power, defects of images and different aberrations, Interference of light, Young's double slit experiment, Interference in thin film and Newton's ring method, diffraction of light, diffraction by single slit, diffraction by double slits, Fraunhofer and Fresnel bi-prism, diffraction gratings, polarization of light, Brewster's law, Malus law, polarization by double refraction Nicole prism, optical activity and polarimeters, optical instruments, resolving power of optical instrument, Laser: spontaneous and stimulated emission

Modern physics: Galilean relativity & Reference frame, Special theory of relativity postulates, Galilean transformation, Lorentz Transformation, Length contraction, Time dilation, Velocity addition, relativity of mass, mass energy relation, Momentum energy relation, Photoelectric effect, Compton effect, de Broglie matter wave, Bohr atom model and explanation, atomic orbital and energy equation, classification of nucleus, nuclear binding energy, radioactivity, radioactive decay law, half-life, mean life, nuclear reaction, introduction to nuclear reactor

SKILL MAPPING(CO-PO MAPPING)

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **Define** different basic parameters in the field of Waves and Oscillations, Optics and Modern physics such as periodic motion, simple harmonic motion, undamped oscillations, interference, diffraction, polarization and prism, photoelectric effect, Compton effect, matter wave, atomic model, radioactive decay, fusion, fission etc.	3											
CO2	Be capable to **Explain** different basic theories in the field of Waves and Oscillations, Optics and Modern physics such as the wave motion for different systems along with energy, different formula for interference, diffraction, polarization special theory of relativity, Compton theory, nuclear transformation, and nuclear reaction etc.	3											
CO3	Be skilled to **Solve** quantitative problems in the field of Waves and Oscillations, Optics and Modern physics such as energy of wave motion, wavelength, diffraction pattern, relativistic energy, photon energy, Compton shift, nuclear binding energy etc.	3											

(3 – High, 2- Medium, 1-low)

Justification for CO-PO Mapping:

Mapping	Corresponding Level of Matching	Justification
CO1-PO1	3	The conceptual knowledge of the natural sciences applicable to the engineering discipline
CO2-PO1	3	The theory-based knowledge of the natural sciences applicable to the engineering discipline
CO3-PO1	3	The numerical analysis based knowledge of the natural sciences applicable to the engineering

TEACHING 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	 84 21
	Formal Assessment Continuous Assessment Mid-Term Final Examination	 2 1 3
	Total	153

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Weeks	**Topics**	**Remarks**
Week-1	Introductory class: Brief discussion on total syllabus, basic requirements of the course, assessment of the course	Class Test 1
	Simple harmonic motion (SHM) and its differential equations, graphical representation of SHM	
	Average K.E and total energy	
Week-2	Spring-mass system , electric oscillatory circuit	
	Simple, compound and torsional pendulum	
	Combination of two SHM	
Week-3	Combination of two SHM	
	Two body oscillations, reduced mass	
	Damped oscillations and its differential equation	
Week-4	Displacement equation of damped oscillation, electric damped oscillatory circuit	Class Test 2
	Forced oscillation and its differential equation	
	Displacement equation of forced oscillation, resonance	
Week-5	Plane progressive wave, energy density of wave	
	Stationary wave	
	Lens and combination of lenses, power of lens	
Week-6	defects of images and different aberrations	
	defects of images and different aberrations	
	Interference of light, young's double slit experiment	
Week-7	Interference in Thin films, Newton's ring	
	Diffraction : Fresnel & Fraunhofer diffraction	
	Diffraction by single slit	
Week-8	Diffraction by double slit, Diffraction gratings	Mid Term
	Polarization and Production and analysis of polarized light	
	Optics of crystals, Nicole prism	

Week-9	Brewster's and Malus law	
	Optical activity and polarimeter	
	Laser & its applications	
Week-10	Theory of relativity: Frame of Reference, Postulates of special relativity, Galilean Transformation	
	Theory of relativity: Lorentz Transformations, Length Contraction and Time dilation	
	Velocity addition, Relativistic mass: Concept of relativistic mass and its expression	
Week-11	Theory of relativity: Mass and Energy equivalence equation and concept of Massless particle and its expression. Related numerical problems	Class Test 3
	Photoelectric Effect, photocurrent and work function, kinetic energy, stopping potential	
	photoelectric equation, characteristics of photoelectric effect	
Week-12	Compton effect: Definition, Compton wavelength shift, limitation	
	De Broglie Concept, Condition for wave and particle behavior, Bohr atomic model	
	Expression for Bohr radii and orbital energy for hydrogen atom	
Week-13	Classification of Nucleus, nuclear binding energy	
	Radioactivity and its transformation, Radioactive Decay Law,	
	half- life, Mean life, nuclear reaction	
Week-14	Concept of Fusion, Fission and nuclear chain reaction	
	General idea on nuclear reactor and nuclear power plant	
	Follow up of the course	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test/ Assignment	20%	CO1, CO3	C1, C2
	Class Participation/ Assignment	5%	CO1, CO3	C1, C2
	Mid-term/ Assignment	15%	CO1, CO3	C1, C2
Final Exam		60%	CO1, CO2, CO3	C1, C2
Total Marks		100%		

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

REFERENCE BOOKS

1. Fundamentals of Physics -Halliday, Resnick and Walker
2. Physics for Scientists and Engineers-Serway and Jewett
3. Concept of Modern Physics-Arthur Beiser
4. University Physics with Modern Physics-Hugh D. Young and Roger A. Freedman
5. Modern Physics for Science and Engineering-Marshall L. Burns
6. Waves and Oscillations-Walter Fox Smith
7. The Physics of Vibrations and Waves-H. J. Pain
8. Waves and Oscillations-BrijLal and Subramannyam
9. Fundamental of Optics-Francis A. Jenkins and Harvey E.White
10. Introduction to Modern Optics-Grant R. Fowles
11. Fundamental Optical Design-Michael J. Kidger

REFERENCE SITE
N/A

COURSE INFORMATION	
Course Code: PHY 102 Course Title: Physics Sessional	Contact Hours: 3.00 Credit Hours: 1.50
PRE-REQUISITE	
N/A	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/RATIONALE	
This course is a laboratory course for the basic physics in the field of Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics. The course will be emphasised the fundamental experiments on different fields of physics which can be applicable in a wide spectrum of engineering disciplines. This laboratory course will enable students to understand basic physics practically as well as do work with team or individual.	
OBJECTIVES	
1. To develop basic physics knowledge practically 2. To practice use of basic scientific instrument.	
COURSE OUTCOMES & GENERIC SKILLS	

No.	Course Learning Outcome	Corresponding POs	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **Define** the different parameters regarding Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc.	PO-1	C1	-	-	K1	Q
CO2	Be capable to **Describe** the different phenomena regarding Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc.	PO-1	C1	-	-	K1	T, F
CO3	Be skilled to **Construct** Experiments by an	PO-9	C2	-	-	K2	F

	individual or by a group to determine different phenomena regarding Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc.						
CO4	Be able to **Prepare** a report for an experimental work.	PO-10	C2			K2	R

**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)

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, electrochemical equivalent (ECE) of copper, wavelength of light, focal length of lens, specific rotation of sugar, conductivity of a bad conductor, acceleration due to gravity, spring constant, the rigidity modulus, conservation of linear momentum, Young's modulus, Planck's constant, specific heat of a liquid.

SKILL MAPPING(CO-PO MAPPING)

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **Define** the different parameters regarding Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc.	3											
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.									2			
CO4	Be able to **Prepare** a report for an experimental work.										1		

(3 – High, 2- Medium, 1-low)

Justification for CO-PO Mapping

Mapping	Corresponding Level of Matching	Justification
CO1-PO1	3	The conceptual knowledge of the natural sciences applicable to the engineering discipline

CO2-PO1	3	The descriptive knowledge of the natural sciences applicable to the engineering discipline
CO3-PO9	2	Able to do work or complete a task as an individual and as a team
CO4-PO10	1	Capable to write a report on an experimental work

TEACHING LEARNING STRATEGY		
Teaching and Learning Activities		Engagement (hours)
	Face-to-Face Learning	
	Lecture Practical / Experiment Student-Centred Learning	10 18 -
	Self-Directed Learning Preparation of Lab Reports Preparation of Lab-test Preparation of Quiz Preparation of viva	 18 25 9 9
	Formal Assessment Continuous Assessment Quiz Final lab exam	 2 1 3
	Total	95

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Design Based Method

COURSE SCHEDULE

Weeks	**Topics**	**Remarks**
Week-1	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’s	
Week-2	Determination of specific resistance of materials of a wire by using Meter Bridge / Determination of focal length of a concave lens by auxiliary lens method	
Week-3	Determination of a high resistance by the method of deflection/ Determination of specific heat of a liquid by the method of cooling	
Week-4	Determination of ECE of copper by using copper voltameter / Determination of the Young’s modulus of bar by bending method	
Week-5	Determination of the wavelength of light by using diffraction grating	
Week-6	Determination of the focal length of a plano-convex lens by Newton’s ring method	
Week-7	Determination of the specific rotation of sugar by poralimeter	
Week-8	Determination of the conductivity of a bad conductor by Lee’s method / Verification of the law of conservation of linear momentum	
Week-9	Determination of the acceleration due to gravity by means of	

	compound pendulum	
Week-10	Determination of the spring constant and the rigidity modulus of a spiral spring	
Week-11	Determination of the Planck's constant using photoelectric effect	
Week-12	Viva & experimental exam	
Week-13	Viva & experimental exam	
Week-14	Quiz exam	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class performance/ Assignment	10%	CO1	C1
	Report Writing/ Assignment	30%	C01, CO4	C1, C2
Final Exam (60%)	Lab test	30%	CO1, CO2, CO3	C1, C2
	Viva	10%		
	Quiz	20%		
Total Marks		100%		

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

REFERENCE BOOKS

1. Practical Physics-G. L. Squires
2. Practical Physics-Dr Giasuddin and Md. Sahabuddin.
3. B.Sc. Practical Physics-C. L Arora
4. Practical Physics-S.L. Gupta and V. Kumar

REFERENCE SITE

N/A

COURSE INFORMATION

Course Code: Math 101 Course Title: Differential and Integral Calculus	Contact Hours: 3.00 Credit Hours: 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

Purpose of this course is to introduce basic knowledge of Differential Calculus and use it to engineering study.

OBJECTIVE

1. Be able to impart basic knowledge on differential and Integral Calculus to solve engineering problems and other applied problems.
2. Developing understanding some of the important aspects of rate of change, area, tangent, normal and volume.
3. Be expert in imparting in depth knowledge of functional analysis such as increasing, decreasing, maximum and minimum values of a function.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Define** the limit, continuity and differentiability of functions, **identify** the rate of change of a function with respect to independent variables and **describe** the different techniques of evaluating indefinite and definite integrals.	C1-C2	1		3	T, F, ASG
CO2	**Apply** the concepts or techniques of differentiation and integration to solve the problems related to engineering study.	C3	1		3	T, Mid Term Exam, F
CO3	**Calculate** the length, area, volume, center of gravity and average value related to engineering study	C3	1		3	Mid Term Exam, F, ASG

**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)

COURSE CONTENT

Differential Calculus: Introduction, Differential Calculus for Engineering, Function and Limit, Continuity and Differentiability, Successive Differentiation, Leibnittz's Theorem, Rolle's Theorem, Mean Value Theorem, Taylor's theorem, Expansion of Finite and Infinite forms, Lagrange's form of remainder, Cauchy's form of remainder, Expansion of functions differentiation and integration, Indeterminate form, Cartesian differentiation, Euler's theorem, Tangent, sub tangent and Normal, sub normal, Maxima and Minima, Curvature, Asymptotes, Partial differentiation.

Integral Calculus: Definition of Integration, Importance of Integration in Eng., Integration by substitution, Integration by parts, Standard integrals, Integration by successive reduction, Definite integrals and its use, Integration as a limit of sum, summing series, Walli's formula, Improper Integrals, beta and gamma function, multiple integral and its application, Area, volume of solid revolution, Area under a plain curve, Area of the region enclosed by two curves, Arc lengths of curves.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12

CO1	**Define** the limit, continuity and differentiability of functions, **identify** the rate of change of a function with respect to independent variables and **describe** the different techniques of evaluating indefinite and definite integrals	3											
CO2	**Apply** the concepts or techniques of differentiation and integration to solve the problems related to engineering study.	3											
CO3	**Calculate** the length, area, volume, center of gravity and average value related to engineering study	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

Justification for CO-PO mapping		
Mapping	Corresponding Level of matching	Justifications
CO1-PO1(a)	3	The knowledge of mathematics, science and engineering sciences has to be applied to describe the complete concept of differential and integral calculus.
CO2-PO1(a)	3	To apply proper and improper integral in the field of engineering study, the knowledge of mathematics, science and engineering sciences is required.
CO3-PO1(a)	3	In order to calculate volume, average, center of gravity and area of any solid revolution object, the knowledge of mathematics, and engineering sciences is needed.

TEACHING 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	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

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

COURSE SCHEDULE		
Week 1		CT 1
Class 1	Introduction to Differential Calculus for Engineering study, Limit of a function and its properties.	
Class 2	Basic limit theorems with proofs, Limit of infinity and infinite limit, Sandwich (Squeezing) theorem with problems.	
Class 3	Concept of Differentiation, definition, classification of discontinuity and solving problems	
Week 2		
Class 4	Basic concept of Differentiability, definition, derivative of a function, differentiable function.	
Class 5	Differentiability – one sided derivatives (R.H.D and L.H.D), solving problems	
Class 6	Successive differentiation – Concept and problem solving	
Week 3		
Class 7	Leibnitz's theorem and its applications	
Class 8	Determination of $(y_n)_0$	
Class 9	Mean Value theorem, Taylor theorem	
Week 4		CT 2
Class 10	Expansion of finite and infinite forms, Lagrange's and Cauchy's form of remainder.	
Class 11	Indeterminate forms – concept and problem solving,	
Class 12	L'Hospital's rules with application	
Week 5		
Class 13	Partial differentiation - partial derivatives of a function of two variables and problems	
Class 14	Partial differentiation - partial derivatives of a homogeneous function of two variables, Euler's theorem for two variables and problems	
Class 15	Partial differentiation - partial derivatives of a homogeneous function of several variables, Euler's theorem for several (three and m) variables and problem solving	
Week 6		
Class 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	
Class 17	Tangents and Normals – Tangents and Normals in polar, Angle between two intersection of two curves, problem solving	
Class 18	Tangents and Normals – Subtangent and subnormals in Cartesian and polar coordinate, problem solving	
Week 7		

Class 19	maxima and minima of functions of single variables – concept, Increasing and decreasing function, Concave up and down with problems	Mid Term
Class 20	Curvature	
Class 21	Asymptotes	
Week 8		
Class 22	Introduction to integral calculus	
Class 23	Standard integrals – concept of definite and indefinite integrals, applications.	
Class 24	Indefinite integrals – Method of substitution, Techniques of integration	
Week 9		
Class 25	Indefinite integrals – Integration by parts, Special types of integration, integration by partial fraction,	
Class 26	Integration by the method of successive reduction	
Class 27	Definite integrals – definite integrals with properties and problems	
Week 10		CT 4
Class 28	Definite integrals – Reduction formula, Walli's formula	
Class 29	Definite integrals – definite integral as the limit of the sum	
Class 30	Beta function – concept and problem solving	
Week 11		
Class 31	Gamma function - concept and problem solving	
Class 32	Relation between beta and gamma function, Legendre duplication formula, problems and applications	
Class 33	Multiple integrals – double integrals	
Week 12		
Class 34	Multiple integrals – triple integrals	
Class 35	Multiple integrals – successive integration for two and three variables	
Class 36	Area in Cartesian	
Week 13		
Class 37	Area in polar	
Class 38	Volume of solid revolution	
Class 39	Area under a plain curve in Cartesian and polar coordinates	
Week 14		
Class 40	Area of a region enclosed by two curves in Cartesian and polar coordinates	
Class 41	Arc lengths of curves in Cartesian coordinates	
Class 42	Arc lengths of curves in polar coordinates	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy

Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2
			CO 2	C3
	Class Participation	5%	CO 3	C3
	Mid term	15%	CO 2, CO3	C3
Final Exam		60%	CO 1	CO 1
			CO 2	CO 2
			CO 3	CO 3
Total Marks		100%		

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

REFERENCE BOOKS

1. Calculus (9th Edition) by Howard Anton (Author), Irl C. Bivens (Author), Stephen Davis.
2. Calculus: An Intuitive and Physical Approach by Morris Kline.

COURSE INFORMATION

Course Code: Math 103 Course Title: Differential Equations and Matrix	Contact Hours: 3.00 Credit Hours: 3.00

PRE-REQUISITE

Math 101

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

Purpose of this course is to introduce basic knowledge to identify and solve differential equations and concept of matrix.

OBJECTIVE

1. Be able to impart basic knowledge on ordinary and partial differential equations.
2. Developing understanding some of the important aspects of ordinary and partial differential equations.
3. Be able to provide knowledge on using concept of Differential equations and matrix in engineering problems and solve other applied problems.
4. Be expert in imparting in depth knowledge on inverse matrix.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Define** various types of differential equations, and **identify** the classifications of partial differential equations.	C1, C2	1		3	T, F, ASG
CO2	**Apply** the knowledge and **solve** ordinary and partial differential equations.	C3	1		3	T, Mid Term Exam, F

CO3	**Apply** the technique to obtain the inverse matrix that **solve** the system of linear equations.	C3	1		3	Mid Term Exam, F, ASG

**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>

(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)

COURSE CONTENT

Differential Equations: Introduction & Formulation of DE in Eng, Degree and order of ODE, solution of first order but higher degree DE by various methods, solution of general DEs of second and higher order, Solution of Euler's homogeneous linear DEs, Solution of DEs by methods based on factorization, Frobenious methods, Bessel's functions, Legendre's polynomial, linear first order PDE, Nonlinear first order PDE, Standard form DEs of higher order and wave equation, particular solutions with boundary and initial condition, Non-linear PDE of order one, Charpit's method, Linear PDE with constant coefficients, Applications of DE.

Matrix: Definition of Matrix, different types of matrices, Algebra of Matrices, Transpose and adjoint of a matrix and inverse matrix, rank and elementary transformation, solution of linear equation or System of Linear Equation, Matrix polynomials determination characteristic roots and vectors, characteristic subspace of matrix and Eigen values and Eigen Vectors, Cayley Hamilton theorem.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Define** various types of differential equations, and **identify** the classifications of ordinary and partial differential equations.	3											
CO2	**Apply** the knowledge to identify and **solve** ordinary and partial differential equations.	3											
CO3	**Apply** the technique to obtain the inverse matrix that **solve** the system of linear equations.	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

Justification for CO-PO mapping

Mapping	Corresponding Level of matching	Justifications

CO1-PO1(a)	**3**	The knowledge of mathematics, science and engineering sciences has to be applied to describe for the physical explanation of differential equations.
CO2-PO1(a)	**3**	The application of differential equations need the knowledge of mathematics, science and engineering for describing exponential growth and decay, the population growth of species or change in investment return over time.
CO3-PO1(a)	**3**	In order to establish for finding the technique to obtain the inverse matrix of mathematics and natural science is required.

TEACHING 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	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Week 1		CT 1
Class 1	Introduction & Formulation of DE in Eng, Degree and order of ODE	
Class 2	Introduction & Formulation of DE in Eng, Degree and order of ODE	
Class 3	Introduction & Formulation of DE in Eng, Degree and order of ODE	
Week 2		
Class 4	Solution of first order but higher degree DE by various methods	
Class 5	Solution of first order but higher degree DE by various methods	
Class 6	Solution of first order but higher degree DE by various methods	
Week 3		
Class 7	Solution of general DEs of second and higher order, Solution of Euler's homogeneous linear DEs	

Class 8	Solution of general DEs of second and higher order, Solution of Euler's homogeneous linear DEs		
Class 9	Solution of general DEs of second and higher order, Solution of Euler's homogeneous linear DEs		
Week 4		CT 2	
Class 10	Solution of DEs by methods based on factorization, Frobenious methods, Bessel's functions, Legendre's polynomial		
Class 11	Solution of DEs by methods based on factorization, Frobenious methods, Bessel's functions, Legendre's polynomial		
Class 12	Solution of DEs by methods based on factorization, Frobenious methods, Bessel's functions, Legendre's polynomial		
Week 5			
Class 13	Linear first order PDE, Nonlinear first order PDE		
Class 14	Standard form DEs of higher order and wave equation		
Class 15	Standard form DEs of higher order and wave equation		
Week 6			
Class 16	Particular solutions with boundary and initial condition, Non-linear PDE of order one: Charpit's method		
Class 17	Particular solutions with boundary and initial condition, Non-linear PDE of order one: Charpit's method		
Class 18	Particular solutions with boundary and initial condition, Non-linear PDE of order one: Charpit's method		
Week 7		Mid Term	
Class 19	Linear PDE with constant coefficients, Applications of DE		
Class 20	Linear PDE with constant coefficients, Applications of DE		
Class 21	Linear PDE with constant coefficients, Applications of DE		
Week 8			
Class 22	Wave equations		
Class 23	Particular solutions with boundary and initial conditions		
Class 24	Particular solutions with boundary and initial conditions		
Week 9			
Class 25	Second order PDE and classifications to canonical (standard)-parabolic, elliptic, hyperbolic solution by separation of variables,		
Class 26	Second order PDE and classifications to canonical (standard)-parabolic, elliptic, hyperbolic solution by separation of variables,		
Class 27	Second order PDE and classifications to canonical (standard)-parabolic, elliptic, hyperbolic solution by separation of variables,		
Week 10		CT 4	
Class 28	Application of OD and PDE in Eng study		
Class 29	Definition of Matrix, different types of matrices, Algebra of Matrices,		
Class 30	Transpose and adjoint of a matrix and inverse matrix		

Week 11	
Class 31	Solution of linear equation or System of Linear Equation
Class 32	Solution of linear equation or System of Linear Equation
Class 33	Solution of linear equation or System of Linear Equation
Week 12	
Class 34	Solution of linear equation using Inverse Matrix
Class 35	Rank, Nullity and elementary transformation
Class 36	Rank, Nullity and elementary transformation
Week 13	
Class 37	Dependent and independent of vectors
Class 38	Dependent and independent of vectors with examples
Class 39	Matrix polynomials determination characteristic roots and vectors
Week 14	
Class 40	Characteristic subspace of matrix and Eigen values and Eigen Vectors,
Class 41	Characteristic subspace of matrix and Eigen values and Eigen Vectors,
Class 42	Cayley Hamilton theorem and its application. Finding inverse matrix using this theorem.

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2
			CO 2	C3
	Class Participation	5%	CO 3	C3
	Mid term	15%	CO 2, CO3	C3
Final Exam		60%	CO 1	CO 1
			CO 2	CO 2
			CO 3	CO 3
Total Marks		100%		

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

REFERENCE BOOKS

1. Elementary Linear Algebra 10th Edition by Howard Anton (Author).
2. Ordinary and Partial Differential Equations By Dr. M.D. Raisinghania , S. Chand Publishing

COURSE INFORMATION	
Course Code: LANG 102	Credit Hour: 1.5
Course Title: Communicative English-1	Contact Hour: 3.0
PRE-REQUISITE	
Nil	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
This course has mainly been designed to improve speaking and oral communication skills of the students. The course includes instructions and experience in speech preparation and speech delivery within various real life situations, formal and informal. Emphasis will be given on various speeches, such as informative, persuasive and interactive. This course will help students progress in real life both personally and professionally. Students will be able to understand class lectures and can comfortably continue the Engineering course, and also to compete in the global job market and increase career skills.	
OBJECTIVE	
1. To develop the four basics skills of English language, i.e. listening, speaking, reading and writing. 2. To develop students' interpersonal skills engaging them in various group interactions and activities. 3. To improve students' pronunciation in order to improve their level of comprehensibility in both speaking and listening. 4. To give the students exposure to different types of texts in English in order to make them informed using different techniques of reading. 5. To gain an understanding of the underlying writing well-organized paragraphs and also to teach how to edit and revise their own as well as peer's writing.	
COURSE OUTCOMES & GENERIC SKILLS	

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to **listen, understand**, and learn the techniques of note taking and answering questions	PO – 1	C2	1		3, 4	Asg
CO2	Able to **understand** and speak English quickly and smartly using the techniques learnt in the class.	PO – 9	C1	5		3	T, Asg,M
CO3	Able to **communicate** effectively within the shortest possible time to present their ideas and opinions.	PO – 1	C2	2		5,6	T, Asg
CO4	Able to **develop** competency in oral, written communication/presentation	PO – 1	C5	2		5,6	T, Asg,Q
CO5	Able to **understand** the techniques of academic reading and summarizing any book/article/literature for review	PO – 1	C2	1		3,4	T, Asg,Q
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)

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
CO1	Able to **listen**, understand, and learn the techniques of note taking and answering questions	3											
CO2	Able to **understand** the techniques of academic reading and academic writing	3											
CO3	Able to **communicate** effectively within the shortest possible time to present ideas and opinions										3		
CO4	Able to **develop** competency in oral, written communication/presentation										2		

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)
JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Ability to listen, understand, and learn the techniques of note taking and answering Questions.
	CO2 – PO1	3	Ability to understand the techniques of academic reading and academic writing.
	CO3 – PO10	3	Ability to communicate effectively within the shortest possible time to present ideas and opinions.
	CO4 – PO2	2	Ability to develop competency in oral, written Communication/presentation.

TEACHING AND LEARNING STRATEGY

	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 12 24 --
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 24 10 20
	Formal Assessment • Continuous Assessment • Final Examination	 6 14
	Total	110

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to Language: Introducing basic skills of language. English for Science and Technology	
	Class 2	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.	
	Class 3	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.	
Week 2			

	Class 4	Asking and answering questions, Expressing likings and disliking, (food, fashion etc.) Asking and giving directions	
	Class 5	Asking and answering questions, Expressing likings and disliking, (food, fashion etc.) Asking and giving directions	
	Class 6	Asking and answering questions, Expressing likings and disliking, (food, fashion etc.) Asking and giving directions	
Week 3			
	Class 7	Discussing everyday routines and habits, Making requests/offers/invitations/excuses/apologies/complaints	
	Class 8	Discussing everyday routines and habits, Making requests/offers/invitations/excuses/apologies/complaints	
	Class 9	Discussing everyday routines and habits, Making requests/offers/invitations/excuses/apologies/complaints	
Week 4			
	Class 10	Describing personality, discussing and making plans(for a holiday or an outing to the cinema), Describing pictures / any incident / event	
	Class 11	Describing personality, discussing and making plans(for a holiday or an outing to the cinema), Describing pictures / any incident / event	
	Class 12	Describing personality, discussing and making plans(for a holiday or an outing to the cinema), Describing pictures / any incident / event	
Week 5			
	Class 13	Practicing storytelling, Narrating personal experiences/Anecdotes	
	Class 14	Practicing storytelling, Narrating personal experiences/Anecdotes	
	Class 15	Practicing storytelling, Narrating personal experiences/Anecdotes	
Week 6			
	Class 16	Telephone conversations (role play in group or pair) Situational talks / dialogues: Practicing different professional conversation (role play of doctor-patient conversation, teacher –student conversation)	
	Class 17	Telephone conversations (role play in group or pair) Situational talks / dialogues: Practicing different professional conversation (role play of doctor-patient conversation, teacher – student conversation)	
	Class 18	Telephone conversations (role play in group or pair) Situational talks / dialogues: Practicing different professional conversation (role play of doctor-patient conversation, teacher –student conversation)	

Week 7			
	Class 19	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	
	Class 20	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	
	Class 21	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	
Week 8			
	Class 22	Difference between different accents: British and American accents, Documentaries from BBC and CNN will be shown and students will try to understand	
	Class 23	Difference between different accents: British and American accents, Documentaries from BBC and CNN will be shown and students will try to understand	
	Class 24	Difference between different accents: British and American accents, Documentaries from BBC and CNN will be shown and students will try to understand	
Week 9			
	Class 25	Listening to short conversations between two persons/more than two	
	Class 26	Listening to short conversations between two persons/more than two	
	Class 27	Listening to short conversations between two persons/more than two	
Week 10			
	Class 28	Reading techniques: scanning, skimming, predicting, inference,	
	Class 29	Reading techniques: scanning, skimming, predicting, inference,	
	Class 30	Reading techniques: scanning, skimming, predicting, inference	
Week 11			
	Class 31	Reading Techniques: analysis, summarizing and interpretation of texts	
	Class 32	Reading Techniques: analysis, summarizing and interpretation of texts	
	Class 33	Reading Techniques: analysis, summarizing and interpretation of texts	
Week 12			
	Class 33	Introductory discussion on writing, prewriting, drafting,	
	Class 35	Introductory discussion on writing, prewriting, drafting,	
	Class 36	Introductory discussion on writing, prewriting,	

		drafting	
Week 13			
	Class 37	Topic sentence, paragraph development, paragraph structure, describing a person/scene/picture, narrating an event	
	Class 38	Topic sentence, paragraph development, paragraph structure, describing a person/scene/picture, narrating an event	
	Class 39	Topic sentence, paragraph development, paragraph structure, describing a person/scene/picture, narrating an event	
Week 14			
	Class 40	Paragraph writing, Compare-contrast and cause- effect paragraph	
	Class 41	Paragraph writing, Compare-contrast and cause- effect paragraph	
	Class 42	Paragraph writing, Compare-contrast and cause- effect paragraph	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Listening Test	15%	CO1, CO2	
	Descriptive writing	25%	CO2	
	Public Speaking	30%	CO1, CO2	
Presentation		30%	CO1	C1
			CO3	C2
			CO4	C1, C2, C4
Total Marks		100%		

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

REFERENCES BOOKS

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.
6. Headway Series – Advanced Level (2 parts with CDs): Oxford University Press Ltd.
7. Speak like Churchill stand like Lincoln - James C. Humes.
8. Cambridge IELTS Practice Book.
9. Selected Sample Reports and Selected Research Articles.

REFERENCE SITE

http://classroom.google.com/...../.........

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 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.	PO – 6	C1,C2	1		7	T, M, F
CO2	Be proficient to **explain** the economy and patterns of economic changes through qualitative and quantitative analysis.	PO – 6	C2,C4	7		7	T, As g,F

**Level of Bloom's Taxonomy:*

C1 – Remember   C2 – Understand   C6 - Create   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)

COURSE CONTENT

a. Main Contents: Impact of Geography, History, Environment, Economy, Constitution and Culture of Bangladesh in Engineering Application

b. Detail Contents:

Bangladesh Geography: Location, Area, Boundary, Physiography, River system, Forest and Climate, 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
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.						3						
CO2	Be proficient to explain the economy and patterns of economic changes through qualitative and quantitative analysis.						3						

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO6	3	Ability 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.
	CO2 – PO6	3	Ability to explain the economy and patterns of economic changes through qualitative and quantitative analysis.

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 at home • Preparation for final examination	8 10 18
	Formal Assessment • Continuous Assessment(Pop Quiz/Class Test/Mid Term Exam) • Final Examination	3 3
	Total	80

TEACHING METHODOLOGY

Lecture, Tutorial, Problem Based Method

COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
Week 1			CT 1
	Class 1	Introductory class: Brief discussion on the total syllabus, basic requirements of the course, methods of assessment of the course	
	Class 2	Bangladesh Geography: Location, Area, Boundary, Physiography, River System, Forest and Climate, Demography of Bangladesh.	
Week 2			
	Class 3	Overview of the ancient Bengal, anthropological identity of the Bengali race, main trends in the history of medieval Bengal	
	Class 4	Bengal under the East India Company	
Week 3			
	Class 5	Religious and Social reform movements	
	Class 6	Nationalist movements, division of the Indian subcontinent	
Week 4			Mid Term Exam
	Class 7	Language movement 1948-1952, Education movement of 1962	
	Class 8	Language movement 1948-1952, Education movement of 1962	
Week 5			
	Class 9	Six-point movement of 1966, Mass uprising of 1969	
	Class 10	War of Independence and Emergence of Bangladesh in 1971	
Week 6			
	Class 11	Constitution of Bangladesh	
	Class 12	Constitution of Bangladesh	
Week 7			
	Class 13	Bangladesh's contribution to world peace and security, Pre and post liberation development of engineering and technology	
	Class 14	Bangladesh's contribution to world peace and security, Pre and post liberation development of engineering	

		and technology	
Week 8			
	Class 15	Land, Characteristics of tropical Monsoon climate, Forests and biomass, Fish	
	Class 16	Engineering development in Bangladesh (Kaptai Dam, Padma bridge, power plants, Karnaphuli River Tunnel etc.) and its impact on socio-economic aspect	
Week 9			
	Class 17	Minerals, Health and Education,	
	Class 18	Agriculture, Industries	
Week 10			CT 2
	Class 19	NGOs, Population, Sociological and Cultural aspects of Bangladesh	
	Class 20	Economy and national development,	
Week 11			
	Class 21	Development and Progress of the Millennium Development Goals (MDGs)	
	Class 22	Ultimate Disposal of Solid Waste: Method Public Administration in Bangladesh, State of Good Governance in Bangladesh	
Week 12			
	Class 23	Art and Literature	
	Class 24	Traditional cultural events	
Week 13			CT 3
	Class 25	Vision-2021, Digitalization	
	Class 26	Tourism and Natural Resources	
Week 14			
	Class 27	Bangladesh and International Relations	
	Class 28	Revision of the course	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO2	C1,C2
	Class Participation	5%	CO2	C2
	Mid Term	15%	CO2	C2,C4
Final Exam		60%	CO1	C1, C2
			CO2	C1,C2,C4
Total Marks		100%		

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

REFERENCES 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
REFERENCE SITE
http://www.google.com

COURSE INFORMATION	
Course Code: Math 201 Course Title: Vector Analysis, Laplace Transformation, and Coordinate Geometry	Credit Hours: 3.00 Contact Hours: 3.00
PRE-REQUISITE	
Math 101 and Math 103	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
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 impart basic knowledge on the vector analysis, laplace transform and geometry. 2. Achieving ability to familiarize the students 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, application of Laplace transform to ordinary differential equations and also solve the problems of the pair of straight lines, circles, system of circles, parabola, ellipse etc.	
COURSE OUTCOMES & GENERIC SKILLS	

No.	Course Outcome	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Know** the physical explanation of different vector notation and **Define** Laplace transform, inverse Laplace transform,	C1-C2	1		3	T, F, ASG

	different types of matrices, and their properties.					
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.	C2	1		3	T, Mid Term Exam, F
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.	C3	1		3	Mid Term Exam, F, ASG

**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)

COURSE CONTENT

Vector Analysis: Definition of Vector and scalers & vector algebra, Scaler and vector products of two vectors and their geometrical interpretation, Triple products and multiple products, Linear dependence and independence of vectors, Differentiation of vectors, Gradient of scaler functions, Divergence and curl of point 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.

Laplace Transform: Definition of LT and Application of LT for Engineering , LT of some elementary functions and properties of LT, Sufficient condition for existence of LT, Inverse LT, LT of derivatives, Unit step function, Periodic function, Some special theorems on LT, Partial fraction, Solution of DEs by LT, Heaviside expansion formula, Convolution theorem, Evaluation of improper integral, Application of LT.

Co-ordinate Geometry: Introduction to geometry for Engineering 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 and properties, 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, 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) and the straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid straight lines, standard equation of coincides, sphere and ellipsoid.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Learn** the physical explanation of different vector notation and **Define** Laplace transform, inverse Laplace transform, different types of matrices, and their properties.	3											
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.	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

Justification for CO-PO mapping

Mapping	Corresponding Level of matching	Justifications
CO1-PO1(a)	3	The knowledge of mathematics, science and engineering sciences has to be applied to describe the operation of being able to identify the physical explanation of different vector notation, explain the complete concept about Laplace transform, 2D and 3D geometry.
CO2-PO1(a)	3	To explain the differentiation and integration of a vector valued functions in Cartesian, cylindrical and spherical geometry and to solve the problems of the pair of straight lines, circles, system of circles, parabola, ellipse etc. the concept of mathematics and engineering sciences is required.
CO3-PO1(a)	3	In order to construct and calculate the area and volume of objects related to engineering study by using vector, solve the differential equations by Laplace transform is needed the

		concept of mathematics, physics and engineering sciences.

TEACHING 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	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

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

COURSE SCHEDULE			
Week 1			
Class 1	Definition of Vector and scalers & vector algebra, Scaler and vector products of two vectors and their geometrical interpretation	CT 1	
Class 2	Definition of Vector and scalers & vector algebra, Scaler and vector products of two vectors and their geometrical interpretation		
Class 3	Definition of Vector and scalers & vector algebra, Scaler and vector products of two vectors and their geometrical interpretation		
Week 2			
Class 4	Triple products and multiple products, Linear dependence and independence of vectors, Differentiation of vectors		
Class 5	Gradient of scaler functions, Divergence and curl of point functions		
Class 6	Physical significance of gradient, divergence and curl		
Week 3			
Class 7	Definition of line, surface and volume integral, Integration of Vectors, Green's theorem and application		
Class 8	Definition of line, surface and volume integral, Integration of Vectors, Green's theorem and application		

	Class 9	Green’s theorem and it’s application		
	Week 4		CT 2	
	Class 10	Gauss theorem and application in Engineering		
	Class 11	Stoke's theorem and it’s application.		
	Class 12	Introduction to geometry for Engineering and Rectangular co-ordinates, Transformation of co-ordinates		
	Week 5			
	Class 13	Introduction to geometry for Engineering 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 and properties		
	Class 14	Changes of axes, pair of straight lines, general equation of second degree and reduction to its standard forms and properties		
	Class 15	Changes of axes, pair of straight lines, general equation of second degree and reduction to its standard forms and properties		
	Week 6			
	Class 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		
	Class 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		
	Class 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		
	Week 7		Mid	

	Class 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	Term	
	Class 20	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points		
	Class 21	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points		
	Week 8			
	Class 22	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points		
	Class 23	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points		
	Class 24	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points		
	Week 9			
	Class 25	Three dimensional co-ordinate system, direction cosines, projections, the plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane) and the straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid		
	Class 26	Three dimensional co-ordinate system, direction cosines, projections, the plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane) and the straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid		
	Class 27	Three dimensional co-ordinate system, direction cosines, projections, the plane		

	(angle between two planes, parallel & perpendicular plane, distance of a point from a plane) and the straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid	
Week 10		CT 4
Class 28	Three dimensional co-ordinate system, direction cosines, projections, the plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane) and the straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid	
Class 29	Definition of LT and Application of LT for Engineering, LT of some elementary functions and properties of LT	
Class 30	Definition of LT and Application of LT for Engineering, LT of some elementary functions and properties of LT	
Week 11		
Class 31	Sufficient condition for existence of LT	
Class 32	LT of derivatives and it's application	
Class 33	LT of Integration with application, LT of sine and cosine integral	
Week 12		
Class 34	Unit step function and its application	
Class 35	Periodic function with examples, LT of some special function.	
Class 36	Definition of inverse Laplace Transform and it's properties	
Week 13		
Class 37	Partial fraction and it's application in inverse Laplace Transform	
Class 38	Heaviside formula and it's application	
Class 39	Convolution theorem, Evaluation of improper integral, Application of LT	
Week 14		
Class 40	Solve ODE s by Laplace transform	
Class 41	Solve PDE s by Laplace transform	
Class 42	Application of LT in Eng. study	

ASSESSMENT STRATEGY

			CO	Blooms Taxonomy
Components		Grading		
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2
			CO 2	C2
	Class Participation	5%	CO 3	C3
	Mid term	15%	CO 2, CO3	C2,C3
Final Exam		60%	CO 1	CO 1
			CO 2	CO 2
			CO 3	CO 3
Total Marks		100%		

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

REFERENCE BOOKS

1. Vector Analysis, 2nd Edition 2nd Edition by Murray Spiegel, Seymour Lipschutz, Dennis Spellman
2. Schaum's Outline of Laplace Transforms by Murray R. Spiegel.
3. Engineering Mathematics, Volume Two 2 II: Containing Coordinate Geometry of Two Dimensions, Co-ordinate Geometry of Three Dimensions, Matrices.
4. Theory of Equations and Vector Calculus by K. Kandasamy, P., Thilagavathy, K., Gunavathy
5. A Text Book on Co-ordinate Geometry with Vector Analysis - Rahman & Bhattacharjee.

COURSE INFORMATION

Course Code: GEA 201 Course Title: Principles of Accounting	Contact hours: 2.00 Credit hours: 2.00

PRE-REQUISITE

N/A

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

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OBJECTIVE

1. Students will demonstrate their knowledge of the fundamental and technical concepts of economics.
2. To work effectively in the organizations with honesty and integrity.
3. Students will be able to understand consumer behavior, elasticity and different market structure.
4. Students will be able to identify the determinants 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. Students will apply the basic theories of economics in critical thinking and problem solving.
6. Students will be able to identify the basic features of economic development and

regarding planning for the economy of the country.

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: NetSuite ERP. Tipalti. Sage Business Cloud Accounting. Sage 50cloud. Plooto. Tradogram. Tally accounting software.

(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 profit calculations
(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

COURSE OUTCOMES AND SKILL MAPPING

COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)												Bloom's taxonomy domain/ level	Assessment tools
	1	2	3	4	5	6	7	8	9	10	11	12		
Understand the cost principle, monetary unit assumption and the economic entity assumption and ethics in financial reporting	√												C2	Pop Quiz, Final Exam
Understand worksheet, preparation of financial statements, cost benefit analysis of different projects.	√												C2	Mid-Term, Final Exam
Acquire knowledge of Management Accounting and **apply** it for preparing and presenting information for management decision-making and control purposes.		√											C3	Class Test, Final Exam

Apply and **analyze** cost-volume profit, budgeting, standard costing and variance analysis.		√											C4	Class Test, Final Exam

TEACHING 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
Assessment Pop Quiz/Class Test/Mid-Term Exam Final examination	 02 03
Total	80

TEACHING SCHEDULE

Lectures	Lecture/Tutorial/Assignment Topic	CT	Remarks
Week-1			
1	Meaning, history and definition of accounting		
2	The users and uses of accounting.		
Week-2			
3	Ethics in financial reporting		
4	The cost principle, monetary unit assumption and the economic entity assumption		
Week-3			
5	Accounting equation and its components		
6	The effects of business transactions on the accounting	1	
Week-4			
7	Four financial statements and how they are prepared.		
8	Journal		
Week-5			
9	Journal		
10	T-account, Ledger, Trial balance		
Week-6			
11	Adjusting Accounts		
12	Worksheet.		

Week-7		2	
13	Completion of the Accounting cycle.		
14	Financial Statement Analysis		
Week-8			
15	Managerial Accounting Basics		
16	Cost Concepts		
Week-9			
17	Job Order Cost Accounting		
18	Job Order Cost Accounting		
Week-10			
19	Process Cost Accounting	3	
20	Process Cost Accounting		
Week-11			
21	Cost-Volume-Profit Relationships		
22	Cost-Volume-Profit Relationships		
Week-12			
23	Performance Evaluation through Standard Costs		
24	Performance Evaluation through Standard Costs		
Week-13			
25	Incremental Analysis		
26	Incremental Analysis		
Week-14			
27	Capital Budgeting		
28	Capital Budgeting		

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Class Test/Class Assignment/Mid Term	40%	CO1, CO2, CO3	C3, C4
Final Exam	60%	CO1, CO2, CO3	C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Financial Accounting IFRS edition by Weygand, Kimmel & Kieso (3th)
2. Accounting Principles by Weygandt, Kieso& Kimmel (IFRS Latest edition)

COURSE INFORMATION	
Course Code: GEE 201 Course Title: Fundamentals of Economics	Contact hours: 2.00 Credit hours: 2.00
PRE-REQUISITE	

N/A
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
-
OBJECTIVE

1. Students will demonstrate their knowledge of the fundamental and technical concepts of economics.
2. To work effectively in the organizations with honesty and integrity.
3. Students will be able to understand consumer behavior, elasticity and different market structure.
4. Students will be able to identify the determinants 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. Students will apply the basic theories of economics in critical thinking and problem solving.
6. Students will be able to identify the basic features of economic development and regarding planning for the economy of the country.

COURSE CONTENT

Broad Topic	**Detail s Topic**
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 and 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.
Economic Problems in Developing Countries especially in Bangladesh.	

COURSE OUTCOMES AND SKILL MAPPING

Course Outcomes (CO) of the Course	Program Outcome												Remarks
	1	2	3	4	5	6	7	8	9	10	11	12	
Understand the basic concepts and principles of Micro and Macro Economics	√												
Identify and apply the indifference curve theory and market equilibrium in real life situation	√												
Explain time-value of money concept and **apply** the knowledge of inflation, investment and cost benefit analysis		√											
Understand the Economic Development and Planning for the country. To get idea of international economy.	√												

TEACHING 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
Assessment Pop Quiz/Class Test/Mid-Term Exam Final examination	02 03
Total	80

TEACHING SCHEDULE

Weeks	Lectures	Lecture/Tutorial/Assignment Topic	References/Teaching Materials/Equipment
1	1	Introduction to Engineering Economics Importance of Economics in Engineering.	Lecture notes, Reference texts/ video clips/etc.
	2	Definition of economics, Difference between micro and macroeconomics. Production possibility frontier (PPF) and Engineering choice.	
2	3	Demand and determinants of Demand	
	4	Demand curve related basic idea and Mathematical Application	
3	5	Supply and Determinants. Market Mechanism.	
	6	Consumer Choice (Indifference Curve and Budget Line)	
4	7	Indifference Curve, Properties of IC, MRS	
	8	Theory of production in the point of view of Engineers	
5	9	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	

	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		
	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		
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	Blooms Taxonomy
Class Test/Class Assignment/Mid Term	40%	CO1, CO2, CO3	C3, C4
Final Exam	60%	CO1, CO2, CO3	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	
Understanding social phenomena	
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	PO – 1,2	C1,C2	1		7	Asg, T,F
CO2	Be proficient to **apply** sociological imagination to the context of social problems of BD society	PO – 3	C3	1		7	T,F
CO3	Be able to **understand** the stages of social research processes and methodologies	PO – 7	C2	1		7	M,F
CO4	Be skilled enough to **analyze** different cultures, civilizations and different social problems and design solutions for those	PO –11	C4	3		7	M,F
CO5	Be able to **understand** and analyze social stratification, different social systems, socialism, capitalism and relate them to BD society	PO – 7	C2	1		7	Asg, T,F
CO6	Be able to **apply** contextual knowledge to assess societal and cultural issues in environmental context for sustainable development	PO – 7	C3	1		7	T,F

**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)

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
CO1	Be able to understand the basic nature, scope and perspectives of sociology	3	3										
CO2	Be proficient to apply sociological imagination to the context of social problems of BD society			2									
CO3	Be able to understand the stages of social research processes and methodologies							2					
CO4	Be skilled enough to analyze different cultures, civilizations and different social problems and design solutions for those											2	
CO5	Be able to understand and analyze social stratification, different social systems, socialism, capitalism and relate them to BD society							3					
CO6	Be able to apply contextual knowledge to assess societal and cultural issues in environmental context for sustainable development							2					

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1-PO1	3	Knowledge of natural science helps to understand the basic nature, scope and perspectives of sociology
	CO1-PO2	3	Ability to identify the basic nature, scope and perspectives of sociology
	CO2-PO3	2	Ability to apply sociological imagination to the context of scial problems of BD society
	CO3-PO7	2	Ability to understand the stages of social research processes and

			methodologies in societal and environmental contexts
	CO4-PO11	2	Skilled enough to analyze different cultures, civilizations and different social problems and design solutions
	CO5-PO7	3	Ability to understand and analyze social stratification, different social systems, socialism, capitalism and relate them to BD society
	CO6-PO7	2	Ability to apply contextual knowledge to assess societal and cultural issues in environmental context for sustainable development

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 at home • Preparation for final examination	 8 10 18
	Formal Assessment • Continuous Assessment(Pop Quiz/Class Test/Mid Term Exam) • Final Examination	 3 3
	Total	80

TEACHING METHODOLOGY

Lectures, class performances, assignments, class tests, final exam

COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
Week 1			CT 1
	Class 1	Definition, nature and scope of sociology	
	Class 2	Sociological imagination	
Week 2			
	Class 3	Perspectives of sociology	
	Class 4	Orientation of sociological theories	
Week 3			
	Class 5	Social research and its process.	
	Class 6	Research designs and techniques	
Week 4			
	Class 7	Introducing culture and its variations 8	
	Class 8	civilization	

Week 5			
	Class 9	Defining family and its changes	
	Class 10	Socialization process and development of self	
Week 6			Mid Term Exam
	Class 11	Introducing globalization and its impact on human life	
	Class 12	Factors responsible to globalization	
Week 7			
	Class 13	Media and its impact in modern society	
	Class 14	Addressing social problems of Bangladesh	
Week 8			
	Class 15	Introducing social groups and organizations	
	Class 16	Introducing bureaucracy and good governance	
Week 9			CT 2
	Class 17	Introducing social stratifications and social inequality	
	Class 18	Poverty and its types and dimensions	
Week 10			
	Class 19	Industrial revolution and aftermath	
	Class 20	Urbanization and city development	
Week 11			CT 3
	Class 21	Capitalism: features and influence	
	Class 22	Socialism: features and influence	
Week 12			
	Class 23	Environment and human activities	
	Class 24	Climate change and global risk	
Week 13			
	Class 25	Population of Bangladesh: problem or prospect	
	Class 26	Crime and deviance: a brief analysis	
Week 14			
	Class 27	Review 1	
	Class 28	Review 2	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO2,CO3,CO4	C1,C2,C3
	Class Participation	5%	CO3,CO4	C2,C4
	Mid Term	15%	CO4,CO5	C2,C4
Final Exam		60%	CO1	C1, C2
			CO2	C3
			CO3	C2
			CO4	C4
			CO5	C2
			CO6	C3
Total Marks		100%		

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

REFERENCES 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
REFERENCE SITE
http://www.google.com

COURSE INFORMATION				
Course Code	: LANG 202		Credit Hour	: 1.5
Course Title	: Communicative English -II		Contact Hour	: 3.0

PRE-REQUISITE
Communicative English II
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 especially in reading and writing. The approach will be communicative and interactive and will involve individual, pair and group work. Students will be exposed to different types of texts to develop efficient reading skill. Reading will also involve activities and discussions leading to effective writing. 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. Emphasis is particularly put on the various forms of essay writing such as descriptive, narrative, cause-effect, compare-contrast, and argumentative. Upon completion of this course, students are expected to be able to communicate at various situations, participate in group activities and prepare formal speech for academic, professional and social purposes. This course also incorporates classroom instructions to provide guidelines on presentations and communication skills. In addition, the course emphasizes on 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 OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to **understand** the technics of academic reading and become familiar with technical terms.	PO – 1	C2	1		3, 4	Asg
CO2	Able to **develop** competency in academic reading, preparing report written	PO – 9	C1	5		3	T, Asg,M

	communication/presentation.						
CO3	Able to **analyse** any problem critically, analyse and interpret data and synthesize information to provide valid conclusions.	PO – 1	C2	2		5,6	T, Asg
CO4	Able to **communicate** effectively within the shortest possible time to present their reports and academic writings	PO – 1	C5	2		5,6	T, Asg,Q
CO5	Able to **apply** the technics to find out the main points of any long article within a very limited time as well as know the technics of any effective writing. In short with consistent practice they will be able to overcome language barrier.	PO – 1	C2	1		3,4	T, Asg,Q

**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)

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, Statement of Purpose (SOP) writing, Proposal Writing: writing steps, principles and techniques, outlining, revising, editing, proofreading, Report writing, article 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: How to get ready for any Speech. 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.

Listening: Listening to long lecture on some topics, Listening and understanding speeches/lectures of different accent.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Able to **understand** the techniques of academic reading and become acquainted with technical vocabularies	3											

CO2	Able to **understand** the techniques of effective academic writing such as research article/report writing	3											
CO3	Able to **communicate effectively** within the shortest possible time to present any report and research work										3		
CO4	Able to **analyze** any problem critically, analyze and interpret data and synthesize information to provide valid conclusions										2		

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Ability to understand the techniques of academic reading and become acquainted with technical vocabularies.
	CO2 – PO1	3	Ability to understand the techniques of effective academic writing such as research article/report writing.
	CO3 – PO10	3	Ability to communicate effectively within the shortest possible time to present any report and research work.
	CO4 – PO2	2	Ability to analyze any problem critically, analyze and interpret data and synthesize information to provide valid conclusions.

TEACHING AND LEARNING STRATEGY

	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 12 24 --
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 24 10 20
	Formal Assessment • Continuous Assessment • Final Examination	 6 14
	Total	110

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method			
COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Reading Comprehension: Practice using different techniques	
	Class 2	Reading Comprehension: Practice using different techniques	
	Class 3	Reading Comprehension: Practice using different techniques	
Week 2			
	Class 4	Academic reading: comprehension from departmental or subject related passages	
	Class 5	Academic reading: comprehension from departmental or subject related passages	
	Class 6	Academic reading: comprehension from departmental or subject related passages	
Week 3			
	Class 7	Vocabulary for Engineers (some common Engineering terms for both general and dept specific) Reading subject specific text to develop vocabulary	
	Class 8	Vocabulary for Engineers (some common Engineering terms for both general and dept specific) Reading subject specific text to develop vocabulary	
	Class 9	Vocabulary for Engineers (some common Engineering terms for both general and dept specific) Reading subject specific text to develop vocabulary	
Week 4			
	Class 10	Writing semi-formal, Formal/official letters, Official E-mail	
	Class 11	Writing semi-formal, Formal/official letters, Official E-mail	
	Class 12	Writing semi-formal, Formal/official letters, Official E-mail	
Week 5			
	Class 13	Applying for a job: Writing Cover Letter and Curriculum Vitae	
	Class 14	Applying for a job: Writing Cover Letter and Curriculum Vitae	
	Class 15	Applying for a job: Writing Cover Letter and Curriculum Vitae	
Week 6			
	Class 16	Statement of Purpose (SOP) writing: writing steps, principles and techniques, outlining, revising, editing, proofreading,	
	Class 17	Proposal writing: writing steps, principles and techniques, outlining, revising, editing, proofreading,	
	Class 18	Proposal writing: writing steps, principles and techniques, outlining, revising, editing, proofreading,	
Week 7			

	Class 19	Report writing: comparison-contrast and cause – effect, argumentative and opinion expression, assignment writing,	
	Class 20	Article writing: comparison-contrast and cause – effect, argumentative and opinion expression, assignment writing,	
	Class 21	Article writing: comparison-contrast and cause – effect, argumentative and opinion expression, assignment writing,	
Week 8			
	Class 22	Analyzing and describing graphs or charts	
	Class 23	Analyzing and describing graphs or charts	
	Class 24	Analyzing and describing graphs or charts	
Week 9			
	Class 25	Practicing analytical and argumentative writing	
	Class 26	Practicing analytical and argumentative writing	
	Class 27	Practicing analytical and argumentative writing	
Week 10			
	Class 28	Public Speaking: Basic elements and qualities of a good public speaker	
	Class 29	Public Speaking: Basic elements and qualities of a good public speaker	
	Class 30	Public Speaking: Basic elements and qualities of a good public speaker	
Week 11			
	Class 31	Set Speech: How to get ready for any speech.	
	Class 32	Set Speech: How to get ready for any speech.	
	Class 33	Set Speech: How to get ready for any speech.	
Week 12			
	Class 34	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.	
	Class 35	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.	
	Class 36	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.	
Week 13			
	Class 37	Listening to long lecture on some topics	
	Class 38	Listening to long lecture on some topics	
	Class 39	Listening to long lecture on some topics	
Week 14			
	Class 40	Listening and understanding speeches/lectures of different accents	
	Class 41	Listening and understanding speeches/lectures of different accents	

	Class 42	Listening and understanding speeches/lectures of different accents	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Testing vocabulary level	20%	CO1, CO2	
	Argumentative/analytical writing	25%	CO2	
	Individual Presentation	25%	CO1, CO2	
Group Presentation		30%	CO1	C1
			CO3	C2
			CO4	C1, C2, C4
Total Marks		100%		

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

REFERENCES 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. 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

REFERENCE SITE

http://classroom.google.com/...../.........

5.3. Courses Offered by Academic Wing

COURSE INFORMATION	
Course Code: GERM 352	Credit Hour: 2.0
Course Title: Fundamentals of Research Methodology	Contact Hour: 4.0

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 develop a research orientation among the UG students and to acquaint them with fundamentals of research methods. 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, and ethical considerations in the field of research methodology.

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 and formulate problem statement and research questions/objectives.	PO – 2	C2	1		1	Asg , Q
CO2	Be proficient to **formulate and compose** a research proposal considering research activities/design, background studies, and following standard guidelines.	PO – 3,12	C2	2		3,6, 8	Asg , Q, R, Pr
CO3	Be expert to **develop** writing and presentation skill, and demonstrate ethical considerations in conducting research.	PO-8,10	C3	3		4,8	Asg , R, Pr

**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)

COURSE CONTENT

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, and Concept of theory, empiricism, deductive and inductive theory, Characteristics of scientific method.
2. 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.

3. 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.
4. 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.
5. 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.
6. 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)

o	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to understand the research fundamentals and formulate problem statement and research questions/objectives.		3										
CO2	Be proficient to formulate and compose a research proposal considering research activities/design, background studies, and following standard guidelines.			1									2
CO3	Be expert to develop writing and presentation skill, and demonstrate ethical considerations in conducting research.								1		3		

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO2	3	Ability to understand the research fundamentals and formulate problem statement and research questions/objectives.
	CO2 – PO3	1	Skilled enough to formulate and compose a research proposal considering research activities/design, background studies, and following standard guidelines
	CO2 –PO12	2	Preparation for and depth of continuing

			learning in formulatin and composing a research proposal considering research activities/design, background studies, and following standard guidelines.
	CO3 – PO8	1	Ability to develop writing and presentation skill, and understand ethical considerations in conducting research
	CO3 –PO10	3	Ability to enhance level of communication to conduct research

TEACHING AND LEARNING STRATEGY		
	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	48 24 12 12
	Self- Directed Learning • Non-face-to-face learning • Report Preparation	30 12 18
	Formal Assessment • Continuous Assessment • Report Submission (2) • Presentation (2)	 1.5 -- 0.5
	Total	80

TEACHING METHODOLOGY	
	Lecture and Discussion Mini-Seminars by Experts Co-operative and Collaborative Method Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1 Class 2 Class 3 Class 4	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.	
Week 2			
	Class 5 Class 6 Class 7 Class 8	Practice session on Foundations of Research	
Week 3			
	Class 9 Class 10 Class 11 Class 12	Problem Identification & Formulation: Meaning & need of Review of Literature, How to Conduct the Review of literature, Research Question – Investigation Question – Measurement Issues –	Continuous Assessment (presentation/ quiz/other

		Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance.	assignment)
Week 4			
	Class 13 Class 14 Class 15 Class 16	Practice session on Problem Identification & Formulation	
Week 5			
	Class 17 Class 18 Class 19 Class 20	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	
Week 6			Assignment 1 Assignment has to provide before, here students will submit report and give PPT
	Class 21 Class 22 Class 23 Class 24	Practice session on Research Design	
Week 7			
	Class 25 Class 26 Class 27 Class 28	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.	
Week 8			
	Class 29 Class 30 Class 31 Class 32	Practice session on Data Analysis	
Week 9			
	Class 33 Class 34 Class 35 Class 36	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.	
Week 10			Continuous Assessment (presentation/ quiz/other assignment
	Class 37 Class 38 Class 39 Class 40	Practice session on Research misconduct and Ethics	
Week 11			
	Class 41 Class 42 Class 43 Class 44	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.	

Week 12			
	Class 45 Class 46 Class 47 Class 48	Practice session on Use of tools / techniques for Research	
Week 13			Assignment 2 Assignment has to provide before, here students will submit report and give PPT
	Class 49 Class 50 Class 51 Class 52	Review Session (Theory) – I /Final Presentation	
Week 14			
	Class 53 Class 54 Class 55 Class 56	Review Session (Practice) – II /Final Presentation	

ASSESSMENT STRATEGY

Assessment Criteria		CO	Bloom's Taxonomy
Components	Grading		
Assignment I	20%	CO1 and CO3	C2,C3
Assignment I	50%	CO2 and CO3	C2,C3
Continuous Assessment	30%	CO1 and CO2	C2,C3
Total Marks	100%		

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

REFERENCES 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.

REFERENCE SITE
http://www.google.com

5.4. Courses Offered by Department of Civil Engineering (CE)

COURSE INFORMATION	
Course Code: MATH 203	Credit Hour: 3.0
Course Title: Applied Mathematics for Engineering	Contact Hour: 3.0
PRE-REQUISITE	
MATH 101 (Differential and Integral Calculus), MATH 103 (Differential Equations and Matrix), MATH 201 (Laplace Transformation, Vector Analysis 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 probability and statistics. Students will also be able to evaluate uncertainty in engineering systems.	
OBJECTIVE	
1. To learn 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. 2. To deal engineering problems with probability and statistics into mathematical frameworks and solve the resulting models.	

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **apply** probability distribution theory and Bayesian inference to engineering problems dealing with probability and statistics.	PO – 1	C3	1		1	T, F
CO2	Be expert in **developing** and run simple probabilistic models to evaluate uncertainty in engineering systems.	PO – 2,5	C4	1, 3		1, 2	T, M, F

**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)

COURSE CONTENT
Review of differential equations, power series solution of differential equations and their applications: Frobenius method, Legendre's polynomials, gamma function, Bessel's

function, integral form of differential equation and its application to engineering problem solving. Fourier series and its properties, application to engineering problem solving, Fourier integral, Fourier transforms and their uses in solving boundary value problems, diffusion equation, wave equation, Laplace equation and their applications. Application of statistical methods to engineering problems: Random variables, discrete and continuous probability distributions, functions of random variables and derived distributions, expectation and moments of random variables, point estimation of distribution parameters: methods of moments and maximum likelihood, Bayesian analysis, confidence intervals, hypothesis tests, nonparametric statistical tests, simple and multiple linear regression and basic models and model selection, uncertainty and reliability analysis.

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **apply** probability distribution theory and Bayesian inference to engineering problems dealing with probability and statistics.	3											
CO2	Be expert in **developing** and run simple probabilistic models to evaluate uncertainty in engineering systems.	2				3							

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals to **apply** probability distribution theory and Bayesian inference to engineering problems dealing with probability and statistics.
	CO2 – PO1	2	Knowledge of mathematics to **develop** and run simple probabilistic models to evaluate uncertainty in engineering systems.
	CO2 – PO5	3	To create, select and apply appropriate techniques, resources by **developing** and run simple probabilistic models to evaluate uncertainty in engineering systems.

TEACHING AND LEARNING STRATEGY

	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio	 42 --

	• Student – Centered Learning	--
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 9 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Background of statistical applications in EWCE engineering.	
	Class 2	Introduction sample space	
	Class 3	Venn diagram and probability model	
Week 2			
	Class 4	Conditional probability, Joint Probability	CT 1
	Class 5	Baye's theorem, Bayesian statistics	
	Class 6	Probability distribution functions and probability mass function	Mid Term Exam
Week 3			
	Class 7	Joint probability mass function, cumulative distribution function, joint probability density function	
	Class 8	Continuous random variable functions, Indicator random variables	
	Class 9	Variance ,Co-variance of two random variables	
Week 4			
	Class 10	Bernoulli Distribution,	
	Class 11	Binomial distribution	
	Class 12	Poisson distribution	
Week 5			
	Class 13	Moment generating function	
	Class 14	Uniform distribution	
	Class 15	Normal Distribution	
Week 6			
	Class 16	Standard Normal Distribution	
	Class 17	Exponential Distribution	
	Class 18	Central Limit Theorem	
Week 7			
	Class 19	Sample mean and sample variance	
	Class 20	Quality criteria for estimates	
	Class 21	Point estimation	
Week 8			
	Class 22	Method of likelihood method of moments	

	Class 23	Interval estimation	CT 2
	Class 24	Hypothesis testing	
Week 9			
	Class 25	Confidence interval	
	Class 26	Linear Models	
	Class 27	linear regression analysis	
Week 10			
	Class 28	Review of differential equation	
	Class 29	Power series solution of differential equations and their applications	
	Class 30	Frobenius method	
Week 11			
	Class 31	Legendre’s polynomials	
	Class 32	Gamma function	
	Class 33	Bessel’s function	
Week 12			
	Class 34	Integral form of differential equation and its application to engineering problem solving	CT 3
	Class 35	Fourier series and its properties	
	Class 36	Application of Fourier series to engineering problem solving	
Week 13			
	Class 37	Fourier integral	
	Class 38	Fourier transforms	
	Class 39	Uses of fourier transforms in solving boundary value problems	
Week 14			
	Class 40	Diffusion equation	
	Class 41	Wave equation	
	Class 42	Laplace equation and their applications	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom’s Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO2	
	Class Participation	5%	CO2	
	Mid Term	15%	CO1, CO2	
Final Exam		60%	CO1	C3
			CO2	C4
Total Marks		100%		

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

REFERENCES BOOKS

1. Introduction to Probability and Statistics for Engineers and Scientists –Sheldon M. Ross.

REFERENCE SITE

http://classroom.google.com/...../.........

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 (Analytic Mechanics) , EWCE 211 (Mechanics of Solids)	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
It is the design course for reinforced concrete structures, especially 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 also in professional life.	

OBJECTIVE

1. To gain knowledge on the basics of reinforced concrete structure.
2. To become skilled at the design of beam, slab, web reinforcement for beam and bond and anchorage for various members of a building.
3. To become aware of the proper safety and serviceability of reinforced concrete structures.

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Able to **understand** and **analyze** basic performance of concrete and steel as structural material in reinforced concrete structure.	PO –1	C2, C4	1		1, 3	T, F
CO2	Able to **design** different types of beam, slabs and web reinforcement for beam	PO – 3	C2, C3	1, 3		1, 4,5	T, M, F
CO3	Able to **apply** practical design consideration using different safety and serviceability provisions.	PO – 3	C1, C3	1, 3		4, 7	Asg/ CT, F

**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)

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
CO1	Be able to understand and **analyze** basic performance of concrete and steel as structural material in reinforced concrete structure.	3	2										
CO2	Be able to **design** different types of beam, slabs and web reinforcement for beam			3									
CO3	Be able to apply practical design consideration using different safety and serviceability provisions.			2									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of stress and strain will help students to understand the basic performance and mechanism of concrete and steel in reinforced concrete structures.
	CO1 – PO2	2	Student will be able to analyze flexure member under pure bending and performance of concrete can be checked with increase of load.
	CO2 – PO3	3	Using BNBC 2015 and 2020 code provision, student will be able to design building component considering safety and economy.
	CO3 – PO3	2	Students will be able to understand the practical design consideration like serviceability and fire hazard using BNBC provision.

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 final examination	 9 18 46

	Formal Assessment • Continuous Assessment • Final Examination		2 3
	Total		120
TEACHING METHODOLOGY			
Lecture and Discussion, Problem Based Method			
COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to Concrete, Reinforced Concrete and prestressed concrete, load according to BNBC-2016.	
	Class 2	Introduction to strength design and alternate design methods,	
	Class 3	Safety provision of ACI Code, serviceability.	
Week 2			
	Class 4	Fundamental assumption of RC concrete, Behavior under axial load	CT 1
	Class 5	Design example.	
	Class 6	Materials, properties under compression, shrinkage, temperature, stress strain curve, relaxation etc.	
Week 3			
	Class 7	Flexural analysis and design of beam, bending of homogenous beam	
	Class 8	RC concrete beam behavior.	
	Class 9	Design example.	
Week 4			
	Class 10	Design of tension reinforced rectangular beam, ACI Code Provisions	
	Class 11	Underreinforced, overreinforced beam, minimum reinforcement ratio.	
	Class 12	Design of Singly reinforced beam	
Week 5			
	Class 13	Design example of singly reinforced beam	
	Class 14	Design aid, Practical consideration in the design of beam,	
	Class 15	Rectangular beam with tension and compression.	
Week 6			
	Class 16	Doubly Reinforced beam analysis	
	Class 17	Design example of doubly reinforced beam.	
	Class 18	Design example of doubly reinforced beam.	Mid Term Exam
Week 7			
	Class 19	T-beam analysis	

	Class 20	Effective flange width, strength analysis.	
	Class 21	T-beam design example	
Week 8			
	Class 22	T-beam design example	
	Class 23	Shear and diagonal tension in beams**.** Diagonal tension in homogenous elastic beams	CT 2
	Class 24	Reinforced concrete beam without shear reinforcement	
Week 9			
	Class 25	ACI code provision for shear design	
	Class 26	Design Example.	
	Class 27	Design of web reinforcement.	
Week 10			
	Class 28	Design problems.	
	Class 29	Analysis and design of slab, design of one way slab.	
	Class 30	Temperature shrinkage reinforcement, Design example of one way slab.	
Week 11			
	Class 31	Design example and detailing of one way slab.	
	Class 32	Behavior of two way edge supported slab, column supported slab.	
	Class 33	Design procedure of slab using various methods.	
Week 12			
	Class 34	Introduction to moment coefficient method	CT 3
	Class 35	Design example of two way slab using moment coefficient method.	
	Class 36	Design example of two way slab using moment coefficient method.	
Week 13			
	Class 37	Design example of two way slab using moment coefficient method.	
	Class 38	Design and reinforcement detailing of two way slab.	
	Class 39	Bond and anchorage and Development length, fundamental of flexural bond.	
Week 14			
	Class 40	Bond strength and development length, anchorage requirement for web RCC.	
	Class 41	Bar cut-off and bent point of beams, Bar splices.	
	Class 42	Design example of development length.	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom’s

				Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO4	
	Class Participation	5%	CO2	
	Mid Term	15%	CO2, CO3	
Final Exam		60%	CO1	C1, C2
			CO2	C2
			CO3	C3, C4
			CO4	C2, C3, C4
Total Marks		100%		

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

REFERENCES 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.

REFERENCE SITE

http://classroom.google.com/...../.........

COURSE INFORMATION

Course Code: CE 386	Credit Hour: 1.5
Course Title: Civil Engineering Structures Design Sessional	Contact Hour: 3.0

PRE-REQUISITE

EWCE-311 (Structural Analysis and Design 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 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	PO – 1	C3	1		1, 3	R, T, Q

CO2	**Design** the elements of a low rise masonry building.	PO – 3	C5	1, 3		4, 5,6	R, T, Q
CO3	**Design** of various structural components of a slab bridge and a balanced cantilever bridge as per Bridge Design Specifications.	PO – 3	C5	1, 3		4, 5,6	R, T, Pr, Q

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
CO1	Be able to **apply** the basic concepts of limit state design	3											
CO2	Be able to **design** the elements of a low rise masonry building.			2									
CO3	Be able to **design** of various structural components of a slab bridge and a balanced cantilever bridge as per Bridge Design Specifications.			2									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals has to be applied to estimate the design load for building and bridge in different cases.
	CO2 – PO3	2	Knowledge of structural analysis has to be applied to determine loads on slab, beam and soil and hence different parts of the building can be designed or analyzed.
	CO3 – PO3	2	Using the structural knowledge and limit state and code provisions, different parts of a balanced cantilever bridge can be analyzed or designed.

TEACHING AND LEARNING STRATEGY

	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 36 -- --
	Self- Directed Learning	

	• Non-face-to-face learning • Report writing • Preparation for examination	3 12 3
	Formal Assessment • Continuous Assessment • Quiz and Viva	 3 3
	Total	60
TEACHING METHODOLOGY		
	Lecture and Discussion, Problem Based Method	
COURSE SCHEDULE		

		Intended Topics to be Covered	Remarks
Week 1			
	Class 1	Introduction to the design of a masonry building following BNBC guidelines and design of slab of a low rise masonry building.	
Week 2			
	Class 2	Design of Beam	
Week 3			
	Class 3	Design of Stairs	
Week 4			
	Class 4	Design of sunshade and lintel	
Week 5			
	Class 5	Design of Foundation	
Week 6			
			Mid Quiz
Week 7			
	Class 6	Introduction on bridge design and Design of Slab Bridge with detailing	
Week 8			
	Class 7	Introduction to the design of a balanced cantilever bridge. Design of deck slab and railing of a balanced cantilever bridge.	
Week 9			
	Class 8	Analysis of Interior Girder for dead loads and live loads	
Week 10			
	Class 9	Analysis of Interior Girder for dead loads and live loads	
Week 11			
	Class 10	Design of Interior girder	
Week 12			
	Class 11	Design of Exterior girder and diaphragm	
Week 13			
	Class 12	Design of articulation.	
Week 14			
			Final Quiz , Viva / Presentation
ASSESSMENT STRATEGY			

Components	Grading	CO	Bloom's Taxonomy
Class performance	10%	CO1	C3
Class assessment	10%	CO1, CO2	C5
Report Writing	20%	CO1, CO2, CO3	C3 , C5
Quiz	50%	CO1, CO2, CO3	C3 , C5
Viva	5%	CO1, CO3	C5
Presentation	5%	CO3	C5
Total Marks	100%		

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

REFERENCES 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

REFERENCE SITE

http://classroom.google.com/...../.........

COURSE INFORMATION

Course Code: CE 387	Credit Hour: 3.0
Course Title: Design of Civil Engineering Structures II	Contact Hour: 3.0

PRE-REQUISITE

EWCE 101 (Analytic 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 gain knowledge on the basics of reinforced concrete structure.
2. To become skilled at the design of beam, slab and web reinforcement for beam.
3. To become aware of the proper safety and serviceability of reinforced concrete structures and steel structures.

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **understand** basic performance of concrete and steel as structural material in reinforced concrete structures.	PO – 1	C2, C4	1		5,6	CT,M, F

CO2	Be able to **design** component of building structures safely, economically and efficiently.	PO – 3	C4, C5,C6	1		5,6	Pr/M, F
CO3	Be able to **understand** practical design consideration using different safety provisions.	PO –1	C2, C5	1, 3		3	Asg/ CT, F

**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)

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
CO1	Be able to **understand** basic performance of concrete and steel as structural material in reinforced concrete structures.	3											
CO2	Be able to **design** component of building structures safely, economically and efficiently.			3									
CO3	Be able to **understand** practical design consideration using different safety provisions.			2									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of stress and strain will help students to understand the basic performance and mechanism of concrete and steel in reinforced concrete structures.
	CO2 – PO3	3	Using BNBC 2015 and 2020 code provision, student will be able to design building component considering safety and economy.
	CO3 – PO3	2	Students will be able to understand

			the practical design consideration like serviceability and fire hazard using BNBC provision.

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 final examination	 9 18 46
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to column, axial compression	
	Class 2	Lateral ties and spiral	
	Class 3	Design example of rectangular tied column	
Week 2			
	Class 4	Design example of spiral column, spiral design for circular column	CT 1
	Class 5	Strain compatibility analysis and interaction diagram	
	Class 6	Strain compatibility analysis and interaction diagram (contd)	
Week 3			
	Class 7	Design example of column strength interaction diagram	
	Class 8	Design of column under uniaxial loading	
	Class 9	Biaxial bending, Reciprocal load Method	
Week 4			
	Class 10	Design discussion on various foundation	
	Class 11	Footing and foundation: design of wall footing	
	Class 12	Single column footing	
Week 5			
	Class 13	Rectangular footing (contd)	
	Class 14	Design of combined footing	
	Class 15	Design of shear wall	
Week 6			
	Class 16	Design of shear wall (contd)	
	Class 17	Analysis and design of two way slab	
	Class 18	Analysis and design of two way slab	Mid Term

			Exam
Week 7			
	Class 19	Introduction to prestress concrete	
	Class 20	Three concepts of prestressed concrete	
	Class 21	Three concepts of prestressed concrete (contd)	
Week 8			
	Class 22	Three concepts of prestressed concrete (contd)	
	Class 23	Prestressing systems and end anchorage	CT 2
	Class 24	Loss of prestress concrete	
Week 9			
	Class 25	Loss of prestress concrete	
	Class 26	Loss of prestress concrete (contd)	
	Class 27	Loss of prestress concrete (contd)	
Week 10			
	Class 28	Analysis of prestress flexural members	
	Class 29	Analysis of prestress flexural members (contd)	
	Class 30	Analysis of prestress flexural members (contd)	
Week 11			
	Class 31	Design of prestress flexural members	
	Class 32	Design of prestress flexural members (contd)	
	Class 33	Design of prestress flexural members (contd)	
Week 12			
	Class 34	Introduction to steel structure, property of steel.	CT 3
	Class 35	Advantage and disadvantage of steel structure over RCC structure. Introduction to composite structure.	
	Class 36	Limit states for tension member.	
Week 13			
	Class 37	Analysis of tension member, bolted connection	
	Class 38	Analysis based on bolt limit state	
	Class 39	Welded connections, types of weld, weld capacity calculation	
Week 14			
	Class 40	Introduction to compression member, axial capacity of column.	
	Class 41	Design of compression member.	
	Class 42	Introduction to flexure member, bending capacity of beam.	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1, CO4	
	Class Participation	5%	CO2	
	Mid Term	15%	CO2, CO3	
Final Exam		60%	CO1	C1, C2

		CO2	C2
		CO3	C3, C4
		CO4	C2, C3, C4
Total Marks	100%		

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

REFERENCES 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

REFERENCE SITE

http://classroom.google.com/...../.........

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

This course is designed to practically introduce the fundamental principles, mechanism of programming skills and develop basic programming skills to design and develop computer programs. Apart from these, this course will also introduce the important topics related to Arduino programming.

OBJECTIVE

1. To provide practical knowledge of C language.
2. To develop logics which will help them to create programs, applications in C.
3. To learn the basic programming constructs using other languages like C++ and Arduino Programming in future.

COURSE OUTCOMES & GENERIC SKILLS

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	**Solve** problems systematically using a structured logic approach,	PO – 1	C1-C3	1	-	4	Assess ment

	OOP and Arduino programming.						Methods
CO2	**Analyze** the fundamental principles, typical characteristics and mechanisms of a structured programming language.	PO – 3	C4	3	-	4, 5	T, ASG
CO3	**Construct** or develop complete programs for simple to moderate problems individually.	PO – 3	C6	1, 3	2	5,7	T, ASG, Q

COURSE CONTENT

1. **Main Contents:** Introduction to computer programming, Number System, Basic programming Structures, Control Structure, Array, Function, Pointer, Dynamic Memory Allocation, User defined data types, Bitwise Operations, File I/O, header files, preprocessors, error handling, Introduction to C++, Introduction to MATLAB, Introduction to Arduino.

2. **Detailed Contents:**
   - Introduction to computer programming: Programming Concepts, Mathematical problems using printf, scanf
   - Basic programming Structures: Data types and their memory allocation, operators, expressions, basic input/ output
   - Control Structure: if-else, switch case, nested if-else, loop, nested loop
   - Array: one-dimensional array, multi-dimensional array, character array/ string
   - Function: Function definition, function declaration, function call
   - Pointer: Different types of pointers, pass pointer as arguments, call by value vs call by reference
   - Dynamic Memory Allocation: Malloc, calloc, free, realloc
   - User defined data types: Structure, union, enumeration
   - File I/O, header files, preprocessors, error handling
   - Introduction to C++: Basic Ideas of OOP- encapsulation, inheritance and polymorphism, Classes and objects
   - Fundamentals on Arduino Programming: Setup the Arduino software and start outputting code

SKILL MAPPING (CO – PO MAPPING)

No	Course Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **solve** problems systematically using a structured logic approach, OOP and Arduino programming.						3						
CO2	Be able to **analyze** the fundamental principles, typical characteristics and mechanisms of a structured programming language.						3						
CO3	Be able to **construct** or develop complete programs for simple									2			

	to moderate problems individually.													

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING			
	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO6	3	To apply reasoning informed by the contextual knowledge one need to know how to solve problems using a structured logic approach.
	CO2 – PO6	3	To apply reasoning informed by the contextual knowledge one need to know how to practically analyze the fundamental principles, typical characteristics and mechanisms of a structured programming language.
	CO3 – PO9	2	To function effectively as an individual, one need to know how to develop complete programs individually.

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 • Assessment Preparations	 21 -- --
	Formal Assessment • Continuous Assessment • Quiz and Viva	 4 3
	Total	70

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Method

COURSE SCHEDULE			
		Intended Topics to be Covered	Remarks
Week 1			
	Class 1	Mathematical problems using printf, scanf	
Week 2			
	Class 2	Number System: Conversion between different number systems such as binary, octal, decimal and hexadecimal systems	
Week 3			
	Class 3	Control Structure: if-else, switch case, nested if-else, loop, nested loop	
Week 4			

	Class 4	Control Structure: loop, nested loop	
Week 5			
	Class 5	Array: one-dimensional array, multi-dimensional array, character array/ string	
Week 6			
			Mid Quiz
Week 7			
	Class 6	Function: Function definition, function declaration, function call	
Week 8			
	Class 7	Recursion	
Week 9			
	Class 8	Pointer: Different types of pointers, pass pointer as arguments, call by value vs call by reference	
Week 10			
	Class 9	Dynamic Memory Allocation: Malloc, calloc, free, realloc	
Week 11			
	Class 10	Bitwise operations: AND, OR, NOT, XOR, Left shift, Right Shift, File I/O, header files, preprocessors, error handling	
Week 12			
	Class 11	Introduction to C++: Classes and objects,	
Week 13			
	Class 12	Introduction to MATLAB: MATLAB environment, matrices, function, loop, file I/O	
Week 14			
	Class 13	Introduction to Arduino: Setup the Arduino software and start outputting code	Final Quiz , Viva / Presentation

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Lab Test	20%	CO1, CO2, CO3	C1-C3, C4, C6
Class Participation	05%	CO1	C1-C3
Assignment	15%	CO1, CO2, CO3	C1-C3, C4, C6
Online Test – 1	20%	CO1, CO2, CO3	C1-C3, C4, C6
Online Test – 2	20%	CO1, CO2, CO3	C1-C3, C4, C6
Viva/ Quiz	20%	CO2	C4
Total Marks	100%		

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

REFERENCES BOOKS
1. Teach Yourself C (3rd Edition) by Herbert Schildt 2. Programming in Ansi C (6th Edition) by E Balagurusamy 3. C: The Complete Reference (4th Edition) by Herbert Schildt 4. C++: The Complete Reference (4th Edition) by Herbert Schildt 5. C Programming Language (2nd Edition) by Dennis M. Ritche
REFERENCE SITE
http://classroom.google.com/...../.........

5.6. Courses Offered by Department of Electrical, Electronic and Communication Engineering (EECE)

COURSE INFORMATION	
Course Code: EECE 167 Course Title: Basic Electrical Technology	Contact Hours: 3.00 Credit Hours: 3.00
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 OUTCOMES & GENERIC SKILLS

No.	Course Outcomes	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **apply** network theorems to simplify real life complex networks.	2	C3	1		3	T, F
CO2	Be capable to **explain** the structure, operating principle and main features of electrical machines and their applications.	1	C2, C4	1		1,3	T, Mid Term Exam, F

CO3	Be able to **understand** AC circuit concepts and **solve** both single phase and three phase circuit problems.	2	C2, C5	1		3	Mid Term Exam, F, ASG
CO4	Be able to **discover** the basic idea of wiring design and electrical appliances.	3	A1	1		5	ASG, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test , PR – Project , Q – Quiz, ASG – Assignment, Pr – Presentation, R - Report, F – Final Exam)

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.

CO-PO MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **apply** network theorems to simplify real life complex networks.		3										
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.		3										
CO4	Be able to **discover** the basic idea of wiring design and electrical appliances.			1									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)

Face-to-Face Learning LecturePractical / 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 Continuous Assessment Final Examination	 2 3
Total	120

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Week 1	**DC analysis**	CT-1
Class 1	Basic idea about Electrical Circuit, Circuit variables and elements	
Class 2	Applications of electrical circuits, Introduction to basic laws of circuits	
Class 3	Nodes, Branches, Loops, Voltage divider law and examples	
Week 2	**DC analysis (Cont..)**	
Class 4	Current divider law and examples, Wye-Delta transformation	
Class 5	Methods of circuit analysis, Nodal analysis and examples	
Class 6	Mesh analysis and examples, Super node with examples, Basic circuit theorems	
Week 3	**DC analysis (Cont..)**	CT-2
Class 7	Super mesh with examples, Nodal VS Mesh analysis	
Class 8	Superposition theorem, Thevenin's theorem with examples	
Class 9	Norton's theorem with examples, Maximum power transfer in a circuit	
Week 4	**AC analysis**	
Class 10	Introduction: Concept of phasor and complex impedance / admittance	
Class 11	Introduction: Concept of phasor and complex impedance / admittance	
Class 12	Analysis of simple series and parallel circuits	
Week 5	**AC analysis (Cont..)**	
Class 13	Theory of Active power, reactive power, apparent power (volt ampere)	

Class 14	Mathematical Problems of Active power, reactive power, apparent power (volt ampere)	MID Term
Class 15	Power factor and energy associated with these circuits	
Week 6	**AC analysis (Cont..)**	
Class 16	Concept of complex power, Phasor diagram	
Class 17	Impedance triangle and power triangle associated with complex circuits.	
Class 18	Resonance in series and parallel circuits	
Week 7	**Alternator**	
Class 19	Synchronous Generator: Operating principle, Losses in Alternator	
Class 20	equivalent circuit of synchronous Generator, Excitation systems of Synchronous Generator	
Class 21	Emf equation of synchronous generator, Mathematical problems	
Week 8	**Induction Motor**	CT-3
Class 22	Three phase induction motor: principle, Rotating magnetic field	
Class 23	Construction of squirrel cage IM, equivalent circuit, vector diagram, torque-speed characteristics	
Class 24	starting and braking, speed control, starting and torque speed characteristics	
Week 9	**Synchronous Motor**	
Class 25	Synchronous motor: Operation, Starting method of synchronous motor	
Class 26	Vector diagrams of synchronous motor	
Class 27	Effect of loading under different excitation condition.	
Week 10	**Dio de**	
Class 28	Introduction to semiconductor devices and its classifications	
	P-type and N-type materials and doping, Semiconductor diode and its band diagram	
Class 30	Biasing of semiconductor diodes, I-V characteristics of diode and equivalent circuit of diodes, Zener diode and related maths of zener diode.	
Week 11	**BJT**	
Class 31	Introduction to BJT and construction, Principle and operation of BJT	
Class 32	Operating regions of BJT and its different configurations	

Class 33	CB and CE configurations and characteristics curves, Mathematical problems related to CB and CC configurations.
Week 12	**Measuring instruments**
Class 34	Measuring instruments: Ammeters, voltmeters
Class 35	watt meters and multi-meter
Class 36	Analysis of three phase circuits: Three phase supply
Week 13	Polyphase system
Class 37	Balanced and Unbalanced circuits, Power calculation
Class 38	Balanced and Unbalanced circuits, Power calculation
Class 39	Introduction to electrical wiring for residential and commercial loads. Illumination and lighting, Air Conditioning
Week 14	Instrumentation
Class 40	Heating, lifts, intercom, public address system, telephone system and LAN
Class 41	Security system including CC TV, stand by generator and substation design considerations
Class 42	Review Class

ASSESMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2, CO3, CO4	C2, C3, C4, C5, A1
	Class Participation	5%	CO1, CO2, CO3, CO4	C2, C3, C4, C5, A1
	Mid Term	15%	CO2, CO3	C2, C4, C5
Final Exam		60%	CO 1	C3
			CO 2	C2, C4
			CO 3	C2, C5
			CO4	A1
Total Marks		100 %		

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

TEXT AND 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 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.	PO – 1	C1	1		1	R, M, V
CO2	Be able to **identify** the hand tools and instruments and acquire measuring skills.	PO – 5	C1	1		1	R, M, V
CO3	Be able to **acquire** practical skills by performing the experiments in different shops of workshop.	PO – 4	C3	1		1,5	R, F, V

**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, M – Mid Quiz, R – Report, F – Final Quiz, Asg – Assignment V-Viva.)

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, aluminium, Types of electrode, fluxes and their composition, Arc welding defects, Test of Arc welding: Visual, destructive and non-destructive tests. Types of gas welding system and gas welding equipment, Gases and types of 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
CO1	Be able to **study** the basics of workshop engineering practice.	3											
CO2	Be able to **identify** the hand tools and instruments and acquire measuring skills.					2							
CO3	Be able to **acquire** practical skills by performing the experiments in different shops of workshop.				2								

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	3	Knowledge of mathematics, natural science and engineering fundamentals is needed to **study** the basics of workshop engineering practice.
	CO2 – PO5	2	In order to **identify** the hand tools and instruments and acquire measuring skills.
	CO3 – PO4	2	Ability to **acquire** practical skills by performing the experiments in different shops of workshop.

TEACHING AND LEARNING STRATEGY

	Teaching and Learning Activities	Engagement (Hours)
	Face-to-face Learning • Lecture • Practical/ Tutorial/ Studio • Student – Centered Learning	 12 24 --
	Self- Directed Learning • Non-face-to-face learning • Revision of the previous lecture at home • Preparation for final examination	 12 12 14
	Formal Assessment • Continuous Assessment	 24

	• Final Examination	1.5
	Total	99.5

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction	
Week 2			
	Class 2	Study of Electric Arc welding process and various types of joint	
Week 3			
	Class 3	Study on different types of joint by TIG welding and MIG welding	
Week 4			
	Class 4	Study of Gas welding, Gas cutting, Soldering and Brazing	
Week 5			
	Class 5	Study of Lathe Machine and Its Various Operations	
Week 6			
	Class 6	Study of Milling Machine and Its Various Operations	
Week 7			
	Class 7	Mid Quiz	
Week 8			
	Class 8	Study of Shaping Machine and Its Various Operations	
Week 9			
	Class 9	Study of Drilling Machine and Its Various Operations	
Week 10			
	Class 10	Study of Grinding Machine and Its Various Operations	
Week 11			
	Class 11	Study on Sand Mold Preparation using single piece pattern	
Week 12			
	Class 12	Study on Split Pattern and Various Types of Molding Sand Properties	
Week 13			
	Class 13	Study on single pattern double mold preparation and various types of casting defects	
Week 14			
	Class 14	Final Quiz	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous	Class Test/ Assignment	20%	CO1,CO2	

Assessment (40%)	(1-3)			
	Class Participation	5%	CO2	
	Mid Term	15%	CO1, CO3	
Final Exam		60%	CO1	C1
			CO2	C1
			CO3	C3
Total Marks		100%		

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

REFERENCES BOOKS

1. Machine Shop Practice, Vol. 1- Moltrecht, Karl
2. Farm and Workshop Welding- Andrew Pearce

REFERENCE SITE

http://classroom.google.com/...../.........

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 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	PO – 9,10	C1,C2			1	T, R, F
CO2	Be proficient to **understand** the	PO – 9,10,11	C1,C2			1	T,

	role and contribution of a leader in achieving organizational goals						ASG, R, F
CO3	Be skilled to **understand** the contribution of leadership traits and management skills in decision making and solving real life problems	PO – 2,8,9,10,11,12	C1,C2			1	T, ASG, R, F

**Level of Bloom's Taxonomy:*

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

(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)

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 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.
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 work team, 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
CO1	Be able to familiarize with the fundamental concepts of leadership and management skills									3	3		
CO2	Be proficient to understand the role and contribution of a leader in achieving organizational goals									3	3	2	
CO3	Be skilled to understand the contribution of leadership traits and management skills in decision making and solving real life problems		2						2	3	3	2	2

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO9	3	Be able to understand the role in and diversity of team, function effectively in leadership and management
	CO1 –PO10	3	Be able to enhance level of communication in leadership
	CO2 –PO9	3	Be able to understand the role in and diversity of team, function effectively as an individual, leader in a team

	CO2 –PO10	3	Be able to enhance level of communication as a leader in a team
	CO2 – PO11	2	Be able to understand level of activities in different activities as a leader in a team
	CO3 – PO2	2	Be skilled to identify the contribution of leadership traits and management skills in decision making and solving real life problems
	CO3 – PO8	2	Be able to understand the level of practice in decision making and solving real life problems
	CO3 – PO9	3	Be able to understand the role in and diversity in decision making and solving real life problems
	CO3 –PO10	3	Be able to enhance level of communication in decision making and solving real life problems
	CO3 –PO11	2	Be able to understand level of activities in decision making and solving real life problems
	CO3 –PO12	2	Be prepared for and continue learning in decision making and solving real life problems

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 assessments	 10 14 14
	Formal Assessment • Continuous Assessment • Final Examination	 2 3
	Total	80

TEACHING METHODOLOGY

Lecture, Tutorial, Problem Based Method

COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
		Week 1	CT 1
	Class 1	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.	
	Class 2	Management Fundamentals: Definition of management & manager, levels of management, management functions and skills, Mintzberg's managerial roles, Henri Fayol's management principles, strategic management.	
Week 2			
	Class 3	Leadership & Motivation: Motivation, Maslow's hierarchy needs, theory of X & Y, motivators and hygiene factors, goal setting theory, reinforcement theory, equity theory, expectancy theory	
	Class 4		
Week 3			
	Class 5	Leadership: Leadership styles, leadership trait theory, managerial grid, contemporary leadership, conflicts negotiation, leadership issues in 21st century, cross culturalleadership, engineer as a leader and some simple case discussions on leadership (positive and toxic leadership) in the class (Interactive Learning).	
	Class 6		
Week 4			
	Class 7	Case Study – I : Engineer as Great Leaders	
	Class 8		
Week 5			
	Class 9	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.	
	Class 10	Planning and goal setting: Foundation of planning, goals of plan, types of goal, types of goal & plan, goal setting, MBO, well written goal.	
Week 6			
	Class 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.	
	Class 12	Change and Innovation: Change and innovation, internal and external for change, changing process, creativity vs innovation	
Week 7			
	Class 13	Case Study – II : Planning and Goal Setting, A Managerial Approach: Engineer as Great Managers (Interactive Discussions in the Class)	
	Class 14	Attitude: Components of Attitude, behavior model and characteristics model, behavior vs. attitude, job attitude, job involvement, job satisfaction and customer satisfaction.	
Week 8			Mid Term / Project
	Class 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).	
	Class 16	Perception and Individual Decision Making: Factors influencing perception, attribution theory, errors/biases in attribution	
Week 9			
	Class 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.	
	Class 18	Case Study – III : A Case on Decision Making – Involves both leadership and managerial skills (InteractiveDiscussion in the Class)	
Week 10			
	Class 19	Understanding Work Team: Work group, work team,problem solving team, self-managed work team, cross functional team, virtual team, team effectiveness, team challenges.	
	Class 20	HR Management: Process of Human Resource Planning, Class Test 2 Forecasting demand for labor, staffing.	
Week 11			
	Class 21	HR Management: Internal supply of labor, performance Appraisal.	
	Class 22	Operations Management: Project managing basics, goals and boundary of project, WBS, scheduling a project.	
Week 12			
	Class 23	Operations Management: Demand and supply forecasting, inventory control.	CT 2
	Class 24	Exercise – Use of Microsoft Project (MSP) for scheduling a project at student level	
Week 13			
	Class 25 Class 26	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)	
Week 14			
	Class 27	Information Technology and Management: Management Information System (MIS), Enterprise Resource Planning (ERP) - For introductory knowledge.	
	Class 28	Revision	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-2)	20%	CO1, CO2	C1,C2,P1
	Class Participation	5%	CO1,CO2	C1,C2,P1,P2,A1
	Mid Term	15%	CO1,CO2,CO	C1,C2,P1,P2,A1,

			3	A2
Final Exam		60%	CO1	C1,C2,P1,,A1
			CO2	C1,C2,P1,P2,A1, A2
			CO3	C1,C2,P1,P2,A1, A2
Total Marks		100%		

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

REFERENCES 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.
REFERENCE SITE
http://www.google.com

5.9. Courses Offered to Department of Architecture

COURSE INFORMATION	
Course Code: EWCE 2231	Credit Hour: 2.0
Course Title: Building Services I: Plumbing	Contact Hour: 2.0
PRE-REQUISITE	
CURRICULUM STRUCTURE	
Outcome Based Education (OBE)	
SYNOPSIS/ RATIONALE	
The students will learn about the plumbing system of a building which will help them to design plumbing system starting from water supply to wastewater disposal. Moreover, they will have a brief idea about the rural sanitation options in Bangladesh.	
OBJECTIVE	
3. To understand the considerations in designing plumbing system. 4. To address the professional practices in plumbing system. 5. To assess the adequacy of supply, distribution and drainage system. 6. To design efficient plumbing system for a building.	
COURSE OUTCOMES & GENERIC SKILLS	

No	Course Outcome	Corresponding POs	Bloom's Taxonomy*	CP	CA	KP	Assessment Methods
CO1	Be able to **describe** professional practices in plumbing.	PO – 1	C1	1		1, 6	T, F
CO2	Be expert in **analyzing** water supply and disposal requirement for a building.	PO – 2	C4	1		2	T, M, F
CO3	Be proficient in **designing** water storage, fittings and pumps	PO – 3	C6	2		5	Asg,T,F
CO4	Be expert to **ensure** safe water supply and hygienic wastewater disposal.	PO – 6	C5	2,5		7	F

**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)

COURSE CONTENT

Introduction to plumbing, water requirements, water sources; water supply and distribution in buildings. Sewage and sewer system, building plumbing of multi-storied buildings; rural sanitation programs 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
CO1	Be able to **describe** professional practices in plumbing.	1											
CO2	Be expert in **analyzing** water supply and disposal requirement for a building.		2										
CO3	Be proficient in **designing** water storage, fittings and pumps			3									
CO4	Be expert to **ensure** safe water supply and hygienic wastewater disposal.						1						

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low

level of matching)

JUSTIFICATION FOR CO – PO MAPPING

	Mapping	Corresponding Level of Matching	Justifications
	CO1 – PO1	1	Knowledge of engineering fundamentals has to be applied to explore the characterization of different kinds of solid and hazardous wastes and their treatment.
	CO2 – PO2	2	Ability to identify health and environmental issues related to solid waste management.
	CO3 – PO3	3	Ability to design solutions in solid waste management-waste reduction at source, collection techniques, materials and resource recovery/recycling, optimization of solid waste transport, treatment and disposal techniques.
	CO4 – PO6	1	Ability to apply engineering practice, ethics and professional responsibility to ensure waste management for health safety.

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 • Continuous Assessment • Final Examination	 2 3
	Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method

COURSE SCHEDULE

		Intended Topics to be Covered	Assessment
Week 1			
	Class 1	Introduction to Plumbing	CT 1
	Class 2	History of Plumbing	
Week 2			
	Class 3	Source of Water Supply	
	Class 4	Water Supply and Distribution Option for a Community	
Week 3			

	Class 5	Water Supply System for a Building	Mid Quiz
	Class 6	Estimation of Water Demand (Theory)	
Week 4			
	Class 7	Water Demand Calculation	
	Class 8	Underground Water Reservoir Design	
Week 5			
	Class 9	Overhead Water Reservoir Design	
	Class 10	Hydraulics in Plumbing	
Week 6			
	Class 11	Hydraulics in Plumbing	
	Class 12	Pump and Pumping System	
Week 7			
	Class 13	Water Distribution System	
	Class 14	Design of Distribution Pipe	
Week 8			
	Class 15	Plumbing Fixtures and Appliances	CT 2
	Class 16	Building Drainage System: Terminologies	
Week 9			
	Class 17	Types of Building Drainage System	
	Class 18	Drainage System Design	
Week 10			
	Class 19	Processes in Septic Tank	
	Class 20	Septic Tank Design	
Week 11			
	Class 21	Sanitation Condition in Bangladesh	CT 3
	Class 22	Rural Sanitation Option in Bangladesh	
Week 12			
	Class 23	Low-cost Sanitation System: Pit Latrine	
	Class 24	Design of Pit Latrine	
Week 13			
	Class 25	Low-cost Sanitation System: Pour-flush Latrine	
	Class 26	Design of Pour-flush Latrine	
Week 14			
	Class 27	Review Class on Plumbing System	
	Class 28	Review Class on Rural Sanitation System	
ASSESSMENT STRATEGY			

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment (1-3)	20%	CO1,CO3	
	Class Participation	5%	CO2	
	Mid Term	15%	CO2, CO3	
Final Exam		60%	CO1	C
			CO2	C4
			CO3	C6
Total Marks		100%		

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

REFERENCES BOOKS

1. Plumbing Practices by Syed Azizul Haq
2. Water Supply and Sanitation by M. Feroze Ahmed & Md. Mujibur
3. Rahman
4. Sewerage Engineering & Environmental Sanitation by M.A. Aziz
5. Bangladesh National Building Code 2012

REFERENCE SITE

http://classroom.google.com/...../.........