CHAPTER 1

GENERAL INFORMATION

1.1 Introduction of MIST

The necessity of establishing a technical institute for the Bangladesh Armed Forces was felt in the late eighties. In the absence of such an institution, officers of Bangladesh Armed Forces had been graduating from Bangladesh University of Engineering and Technology (BUET), Bangladesh Institute of Technology (BIT), and other foreign institutions of science and technology. With a view to meet the increasing demand for the development and dissemination of engineering and technological knowledge, Bangladesh Armed Forces established the Military Institute of Science and Technology (MIST) that promises 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 started in 2001. Bachelor courses in Electrical, Electronics & Communication Engineering and Mechanical Engineering started its journey from 2003. Bachelor of Science program on Aeronautical Engineering (AE) and Naval Architecture and Marine Engineering (NAME) program were started from 2008-2009 and 2012-2013 respectively. Besides, four new departments started their academic session from 2014-2015 i.e. Nuclear Science & Engineering (NSE), Biomedical Engineering (BME), Architecture (Arch), and Environmental, Water Resources, and Coastal Engineering (EWCE).

Foreign students from Sri Lanka were admitted for the first time at MIST. Presently students from Maldives, Palestine, Nepal, and Gambia are also studying in different Engineering Programs. MIST envisages creating facilities for the military as well as civil students from home and abroad dedicated to pursue standard curriculum leading to Graduation Degree. As an Institution without any gender biasness, MIST is already on steady stride upholding its motto “Technology for Advancement”. MIST remains committed to contributing to the wider spectrum of the national educational arena and play a significant role in the development of human resources and ardently pursuing its goal to grow into a “Centre of Excellence”. MIST has well-equipped classrooms with multimedia and web cameras with internet facilities and laboratories with modern equipment. The medium of instruction for all engineering programs is English. All academic programs of MIST are affiliated with the Bangladesh University of Professionals (BUP) and have close cooperation with Bangladesh University of Engineering and Technology (BUET) and Dhaka University (DU).

1.2 Vision and Mission of MIST

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.

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 research activities with national and international communities for continuous interaction with academicians and industry.

d. To provide consultancy, advisory, testing, and other related services to government, non-government, and autonomous organizations including personnel for widening practical knowledge and contributing to the sustainable development of the society.

1.3 Salient Features of MIST

a. Rigorous admission and selection process for the best possible screening interactive sessions in the classroom.
b. Regular guest lectures and educational visits.
c. Culture of timeliness, commitment, and uninterrupted curriculum.
d. Flexibility in choosing competent faculties through outsourcing.
e. Well-thought-out and continuous feedback and assessment system.
f. Effective teaching through the innovative method.
g. Industrial attachment for on job training.
h. Emphasis on code of conduct and dress code.
i. Focus to develop students as good humans with all possible attributes of a successful leader.
j. Tranquil, pollution-free and secure campus life.

1.4 Location

MIST is located at Mirpur Cantonment, northwest edge of the greater Dhaka city, a hub of knowledge for the armed forces. Mirpur Cantonment is a small, calm, and quiet education village and free from all possible pollution of city life. A garland like a lake with migratory birds, three sides with extended green fields in the summer and water bodies in the rainy season, whistling birds on the tree branches, and overall bounty of nature adds to the already existing splendid academic atmosphere. Other neighboring academic institutions are National Defense College (NDC) and Defense Services Command and Staff College (DSCSC) – two international standard education centers.

1.5 Faculties

1.5.1 Faculty of Civil Engineering (FCE):

- Civil Engineering (CE)
- Architecture (Arch)
- Environmental, Water Resouce and Coastal Engineering (EWCE)
- Petroleum and Mining Engineering (PME)

1.5.2 Faculty of Electrical and Computer Engineering (FECE):

- Computer Science and Engineering (CSE)
- Electrical, Electronic and Communication Engineering (EECE)

1.5.3 Faculty of Mechanical Engineering (FME):

- Mechanical Engineering (ME)
- Aeronautical Engineering (AE)
- Naval Architecture and Marine Engineering (NAME)
- Industrial and Production Engineering (IPE)

1.5.4 Faculty of Science and Engineering (FSE):

- Biomedical Engineering (BME)
- Nuclear Science and Engineering (NSE)
- Department of Science (Mathematics, Physics, Chemistry) and Humanities

Presently MIST has 12 (twelve) departments to conduct B Sc. Engineering program under 04 (four) different engineering faculties. The departments impart education basing on common objectives and outcomes set by MIST and have defined program objectives and outcomes, specific to the departments respectively

1.6 Eligibility of Students for Admission in MIST (Subject to review each year)

The students must fulfill the following requirements:

a. **Bangladeshi Students.** Minimum qualifications to take part in the admission test are as follows:

(1) The applicant must have passed SSC / equivalent examination from Board of Intermediate and Secondary Education/Madrasa Education Board/Technical Education Board in Science Group obtaining GPA 4.00 (without a fourth subject) on a 5 points scale and in HSC/Equivalent examination from Board of Intermediate and Secondary Education/Madrasa Education Board/Technical Education Board in Science group the applicant must have obtained minimum GPA 4.00 on a 5 points scale. In HSC/Equivalent and SSC/Equivalent examination: (i) the applicant passed HSC or Equivalent in must obtain a

minimum total grade point 17 in four subjects (Mathematics, Physics, Chemistry, and English), (ii) SSC Examination (or Equivalent).

(2) The applicant must have qualified in minimum five subjects including Mathematics, Physics, Chemistry and English Language with minimum ‘B’ in average [i.e., A=5, B=4, C=3, D=2 & E=1, minimum required grade point=20] in GCE ‘O’ Level and in ‘A’ level/Equivalent background of Minimum ‘B’ grade in Mathematics, Physics and Chemistry.

(3) Applicants who have passed HSC or equivalent examination in the current previous year must grade obtain 19 in four subjects (Mathematics, Physics, Chemistry, and English).

(4) Sex: Male and Female.

b. **Foreign Students.** Maximum 3% of overall vacancies available will be kept reserved for the foreign students and will be offered to foreign countries through AFD of the Government of the People's Republic of Bangladesh. Applicants must fulfill the following requirements:

(1) Educational qualifications as applicable for Bangladeshi civil students or equivalent.

(2) Must have security clearance from respective Embassy/High Commission in Bangladesh.

(3) Sex: Male and Female.

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

1.7 Number of Seats

The highest number of seats for 04 (Four) years Bachelor Degree in Engineering programmes (Unit – A) and 5 (Five) years Bachelor Degree of Architecture programme 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 & 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 Resource, and Coastal Engineering (EWCE)	60
10.		Industrial and Production Engineering (IPE)	50
11.		Petroleum and Mining Engineering (PME)	25
12.	**B**	Architecture (Arch)	25
	Total		570

1.8 Admission Procedure

1.8.1 Syllabus for Admission Test. Admission test will be conducted on the basis of the syllabus of Mathematics, Physics, Chemistry and English (comprehension and functional) subjects of HSC examinations of all boards of secondary and higher secondary school certificates. There will be no multiple-choice type questions (MCQ). Admission test will be conducted out of 200 marks and the distribution of marks is given below:

Ser.	Subjects	Marks
a.	Mathematics	80
b.	Physics	60
c.	Chemistry	40
d.	English	20
		Total = 200

1.8.2 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. The minimum qualifying marks in the test is 40% for the applicants. 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.

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

1.9 Students Withdrawal Policy

1.9.1 General Policy of Withdrawal

The undergraduate (B.Sc.) Engineering programs for all engineering disciplines are planned for 04 regular levels, comprising of 08 regular terms and for Architecture programme it is planned for 05 regular levels, comprising of 10 regular terms. It is expected that all students will earn a 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 in referred examination as per examination policy. In the case of students completing level-4, a maximum of three courses/subjects will be allowed in the referred examination (which is to be cleared within 6 years of registration).

b. The referred examination will be conducted at this institution before the commencement of the next level.

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 the last chance.

e. In case of sickness, which leads to missing more than 40% of classes 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 for the award of a bachelor’s degree in Engineering (BSc Engg) and Architecture (B Arch) will be decided by the respective department as per 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 from the date of registration.

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

1.9.2 Withdrawal on Disciplinary Ground

a. **Unfair Means**. Adoption of unfair means may result in expulsion of a student from the programme and expulsion so from the Institution. The Academic Council will authorize such expulsion on the basis of recommendation of the Disciplinary Committee, MIST and as per policy approved by the affiliating university. Following would be considered as unfair means adopted during examinations and other contexts:

i. Communicating with fellow students for obtaining help in the examination.

ii. Copying from another student's script/ report /paper.

iii. Copying from desk or palm of a hand or from other incrimination documents.

iv. 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 grades.

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

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.

1.9.3 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.

b. **Temporary Withdrawal.** A student, if he/she applies, may be allowed to withdraw temporarily from the program, subject to approval of Academic Council of MIST, he will be allowed to apply fresh in future batch. If approved from the date of his/her registration.

CHAPTER 2

RULES AND REGULATIONS FOR UNDERGRADUATE PROGRAMME AT MIST

2.1 Introduction

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

2.2 The Course System

The salient features of the Course System are as follows:

a. Number of theory courses will be generally 5 in each term. However, with the recommendation of 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.

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

2.2.2 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 terms (Spring Term I and Fall Term II) in an academic year.

2.4 Duration of Terms

The duration of each of Term I (Spring) and Term II (Fall) (maximum 22 weeks) may be as under:

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

2.5 Course Pattern and Credit Structure

The 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.

2.6 Course Designation System

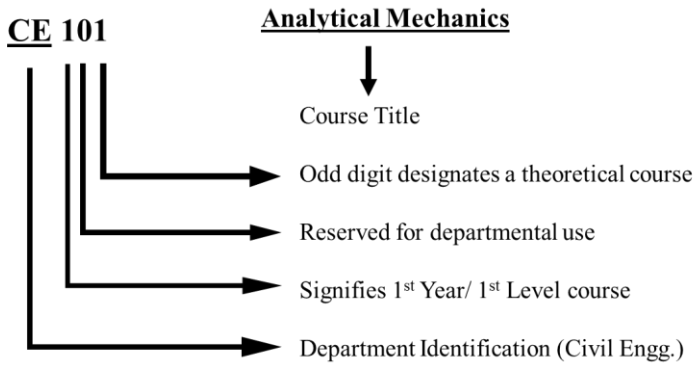
Each course is designated by a maximum of four-letter code identifying the department offering the course followed by a three-digit number having the following interpretation:

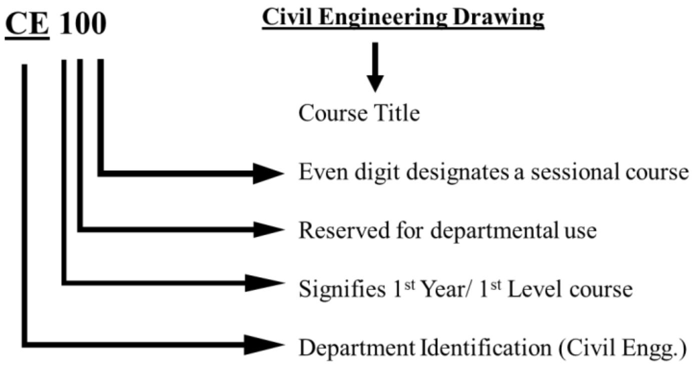
a. The left-most digit corresponds to the year/level in which the course is normally taken by the students. The second digit is reserved for departmental use. It usually identifies a specific area/group of study within the department.

b. The right-most digit is an odd number for theoretical courses and an even number for sessional courses.

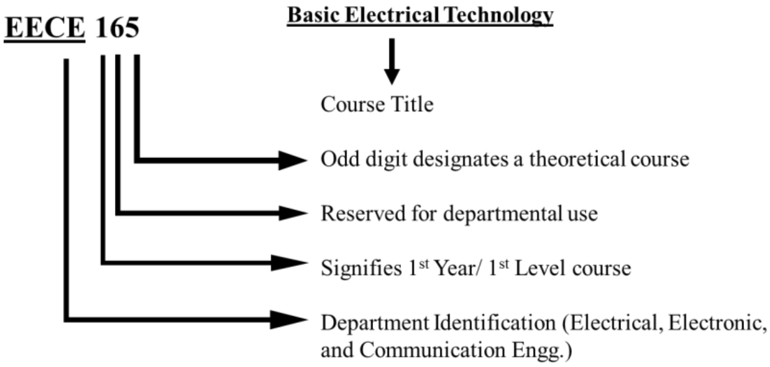
The course designation system is illustrated as Follows:

CE Dept. Courses

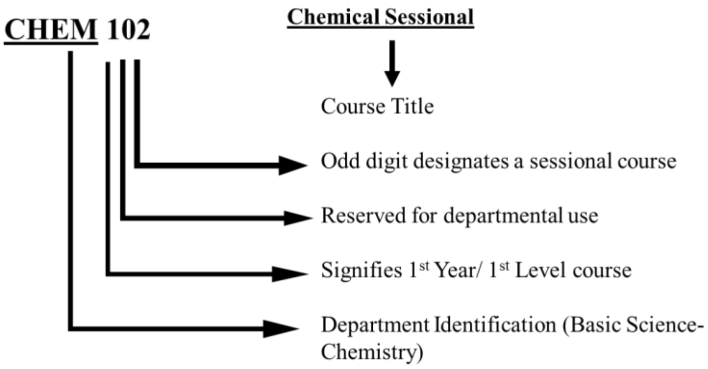




Interdisciplinary Course



Basic Science Course



2.7 <u>Assignment of Credits</u>

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

a. Theoretical Courses: One lecture per week per term is equivalent to one credit.

b. Sessional Courses: Credits for sessional courses is half of the class hours per week per term.

Credits are also assigned to project and thesis work taken by the students. The number of credits assigned to such work varies from one discipline to another.

2.8 Types of Courses

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

a. **Core Courses.** In each discipline, a number of courses are identified as core courses, which form the nucleus of the respective bachelor's degree program. A student has to complete the entire designated core courses of his/her discipline.

b. **Prerequisite Courses.** Some of the core courses are identified as prerequisite courses for a specific subject.

c. **Optional Courses.** Apart from the core courses, the students can choose from a set of optional courses. A required number of optional courses from a specified group have to be chosen.

2.9 Course Offering and Instruction

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

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

2.10 Teacher Student Interaction

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

2.11 Students' 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.

2.11.1 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.

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

2.12 Course Registration

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

2.13 Registration Procedure

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

2.14 Pre-conditions for Registration

a. For first year students, department-wise enrollment/admission is mandatory prior to registration. At the beginning of the first term, an orientation program will be conducted for them where they are handed over with the registration package on submission of the enrolment slip.

b. Any student, other than the new batch, with outstanding dues to the MIST or a hall of residence is not permitted to register. Each student must clear their dues and obtain a clearance certificate, upon production of which, he/she will be given necessary Course Registration Forms to perform course registration.

c. A student is allowed to register in a particular course subject to the class capacity constraints and satisfaction of pre-requisite courses. However, even if a student fails in a pre-requisite course in any term, the concerned department (BUGS) may allow him/her to register for a course which depends upon the pre-requisite course provided that his/her attendance and performance in the continuous assessment of the mentioned pre-requisite course is found to be satisfactory.

2.15 Registration Deadline

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

2.16 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.

2.17 Limits on the Credit Hours to be Taken

2.17.1 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.

2.17.2 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 Comdt, a lesser number of credit hours to suit individual requirements. Only graduating students may be allowed to register less than 15 Cr Hr without the approval of the Commandant. A list of all such cases to be forwarded to Register Office, ICT dept, and Controller of Exam Office by the respective Department.

2.18 Course Add/Drop

2.18.1 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. Dropping a course is permitted within the first four weeks of a regular term. Add or drop is not allowed after registration of courses for Supplementary-I and Supplementary-II Examination.

2.18.2 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.

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

2.19 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 a 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.

2.20 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, 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, 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 weightage. A student's performance is measured by the number of credits completed satisfactorily and by the weighted average of the grade points earned. A minimum grade point average (GPA) is essential for satisfactory progress. A minimum number of earned credits also have to be acquired in order to qualify for the degree. Letter grades and corresponding grade points will be given as follows:

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

55% to below 60%	B-	2.75
50% to below 55%	C+	2.50
45% to below 50%	C	2.25
40% to below 45%	D	2.00
below 40%	F*	0.00
	AB	Absent
	DC	Dis-collegiate
	VW	Voluntary withdrawn
	X	Project/ Thesis Continuatiom
	E	Expelled
	S	Satisfactory

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

2.21 Marks Distrubtion

2.21.1 Theory. Forty percent (40%) marks of a theoretical course shall be allotted for continuous assessment, i.e. quizzes, home assignments, class tests, observations/ class participation, and class attendance. These marks must be submitted to the Office of the 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.

Distribution of marks for a given course per credit is as follows:

Class Performance	5%
Class Attendance	5%
Class Test / Assignment	20%
Mid Term Assessment (Exam / Project)	10%
Final Examination (Section A & B)	60%
Total	**100%**

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

2.21.2 Sessional/Practical Examinations

Sessional courses are designed and conducted by the concerned departments. Examination on sessional/practical subjects will be conducted by the respective department before the commencement of term final examination. The date of practical examination will be fixed by the respective department. Students will be evaluated in the sessional courses on the basis of the followings (all or as decided by the Examination Sub-Committee):

a.	Conduct of Lab Tests/Class Performance	25%
b.	Report Writing/ Programming	15%
c.	Mid-Term Evaluation (Exam/Project/Assignment)	20%
d.	Final Evaluation (Exam/Project/Assignment)	30%
e.	Viva Voce/ Presentation	10%
	Total percentage	**100%**

Note: the above distribution of percentage is a general guideline. Department can rearrange to some extent if required

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

a.	Class performance/observation	10%
b.	Written Assignment	15%
c.	Oral Performance	25%
d.	Listening Skill	10%
e.	Group Presentation	30%
f.	Viva Voce	10%
	Total percentage	**100%**

2.21.4 Class Attendance.

Class attendance may be considered as a part of continuous assessment.

2.21.5 Collegiate and Non-collegiate

Students having class attendance of 90% or above in individual subject will be treated as collegiate and less than 80% 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 75% will be treated as dis-collegiate and will not be allowed to appear in the examination and treated as fail. But in a special case such students may be allowed to appear in the examination with the permission of Commandant and it must be approved by the Academic Council.

2.22 Calculation of GPA

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 $C_1, C_2, \ldots, C_n$ and his grade points in these courses are $G_1, G_2, \ldots, G_n$ 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 $TC_1, TC_2, \ldots, TC_n$ and his GPA in these terms are GPA_1, GPA_2, GPA_n respectively then

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

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
CE 100	1.50	A	3.75	5.625
CE 101	3.00	A+	4.0	12.00
PHY 101	3.00	A-	3.50	10.50
CHEM 101	3.00	A+	4.00	12.00
MATH 101	3.00	B	3.00	9.00
GEBS 101	2.00	B-	2.75	5.50
CSE 176	1.50	B	3.00	4.50
ME 132	1.50	A+	4.00	6.00
CHEM 102	1.50	A	3.75	5.625
Total	20			70.75

GPA = 70.75/20.00 = 3.5375

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	20.00	3.73	74.60
1	2	20.00	3.93	78.60
2	1	20.00	3.96	79.20
2	2	20.00	4.00	80.00
Total		**80.00**		**312.40**

CGPA = 312.40/80 = 3.905

2.23 Minimum Earned Credit and GPA Requirement for Obtaining Degree

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

2.24 Minimum Earned Credit and GPA Requirement for Obtaining Degree (Additional Course)

Minimum credit hour requirements for the award of bachelor's degree in engineering (B.Sc. Engineering) and other discipline will be decided by the respective department (BUGS). However, at least 157 credit hours for engineering must be earned to be elegible for graduation. This must include the specified core courses. The minimum GPA requirement for obtaining a Bachelor's degree in Engineering and Architecture is 2.20. A student may take additional courses with the consent of his Advisor in order to raise GPA, but he/she may take a maximum of 15 such additional credits beyond respective credit-hours requirements for Bachelor’s degree during entire period of study.

2.25 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.

2.25.1 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.

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

2.25.3 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 the B. Arch. program.

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

2.26 Classification of Students

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

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

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

a. **Category 1:** This category consists of students who have passed all thecourses 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.

2.27 Definition of Graduating Student.

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

2.28 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.

2.28.1 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.

2.28.2 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.

2.29 Application for Graduation and Award of Degree

A student who has fulfilled all the academic requirements for the 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.

2.30 Time Limits for Completion of Bachelor’s Degree

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

2.31 Attendance, Conduct and Discipline

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

2.31.1 **Attendance**. All students are expected to attend classes regularly. The university believes that attendance is necessary for effective learning. The first responsibility of a student is to attend classes regularly and one is required to attend the classes as per MIST rules.

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

2.32 Teacher-Student Interaction

The academic system in MIST encourages students to come in close contact with the teachers. For promotion of high level of teacher-student's interaction, a course coordinator (CC) is assigned to each course. Students are free to discuss with CC about all academic matters. Students are also encouraged to meet other teachers any time for help and guidance for academic matters. Heads of the departments, Director of Administration, Director of Students Welfare (DSW), Dean and Commandant address the students at some intervals. More so, monthly Commandant's Parade is organized in MIST where all faculty members, staff and students are formed up, thereby increasing teacher-student interaction.

2.33 Absence during a Term

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

2.34 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.

2.35 Types of Different Examinations (Subject to change for different academic session)

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

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

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

2.36 <u>Rules of Different Examinations (Subject to change for different academic session)</u>

2.36.1 <u>Term Final Examination</u>. Following rules to be followed:

a. Registration to be completed before commencement of the class. A student has to register his desired courses paying registration, examination fee and other related fees.

b. Late registration will be allowed without penalty within first one week of the term.

c. 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 a 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.

d. Registrar office will finalize registration of all courses within 7 (seven) weeks, issue registration slip and that will be followed by issuing Admit Card.

e. Term Final Examination to be conducted in the 18-20th week of the term as per approved Academic Calendar.

2.36.2 <u>Supplementary Examination</u>. Following rules to be followed:

a. Supplementary-I is defined as provision of giving exam in the first week of Spring Term (Jan-Jun) / Fall Term (Jul-Dec) end break and Supplementary-II in the first week of Fall Term (Jul-Dec) / Spring Term (Jan-Jun) end break, respectively.

b. Students will be allowed to register for a maximum of two theory courses (Failed/Improvement) in Supplementary-I and maximum of one theory course (Failed/Improvement) in Supplementary-II.

c. No class will be conducted.

d. 40% marks will be considered from the previous exams.

e. Maximum grading in Supplementary Exam will be 'B+'.

f. No Sessional Exam will be conducted.

g. Examination will be taken on 60% marks like Term Final Examination.

h. If a student fails in a course more than once in regular terms, then for calculating 40% marks best one of all continuous assessment marks will be counted.19

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

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

k. 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 to Jun), paying all the required fees.

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

m. Question Setting, Moderation, and Result Publication to be done following the same rules of Spring (Jan to Jun) / Fall (July to Dec) Term Final Exam as per existing Examination Policy.

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

o. Separate Tabulation sheet to be made.

p. Thesis: if a student cannot complete thesis in two consecutive terms, with the recommendation of the supervisor, he/she may continue for next one/two term within six academic years.

2.36.3 <u>Improvement Examination</u>. Following rules to be followed:

a. Improvement exam should be taken during the supplementary-I and supplementary-II examinations.

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

c. Question Setting, Moderation, and Result Publication to be done with courses of supplementary-I and supplementary-II examinations.

d. Any students gets a grading below 'B+' and desires to improve that course, he will be allowed to appear the improvement examination for that particular course.

e. Highest garde of improvement examination will be 'B+'

f. One student is allowed to appear at Improvement exam in 6 (six) courses in his whole graduation period taking maximum two courses at a time (two courses at supplementary-I and one course at supplementary-II).

2.37 Irregular Graduation

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

CHAPTER 3

DEPARTMENT OF CIVIL ENGINEERING

3.1 Introduction to the program

The CE Department of MIST, standing on the four pillars of morale: fundamentals, innovation, excellence, and advancements, holds its glory of being the pioneer department of MIST. By creating a positive learning environment and sharing the most up-to-date technical knowledge and skills, the department of CE produces next-generation top-notch engineers and leaders for the nation. Since its commencement in 1999 with only 40 military students, this department has emerged to house and train engineering students at the undergraduate level at the current time. It is the first-ever department of MIST to receive accreditation from the Board of Accreditation for Engineering and Technical Education (BAETE) in 2008. In 2018, the department received the highest grade from BAETE during the re-accreditation process. Again in 2019, the department received accredation under Outcome Based Education (OBE) following the guideline of BAETE and Washington Accord. This department has again pioneered the Post Graduate program by introducing the M.Sc. / M. Engg. and Ph.D. in 2012 and 2013 respectively. This department is enriched with highly experienced and disciplined teaching staff having a wide vision. At present, 33 faculties are serving in this department of whom 8 are Ph.D. qualified from home and abroad. This department highly promotes interactive learning and a 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. Besides, 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 infrastructural development. All-in-all, within a very short span of time, the CE 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 B. Sc. in Civil Engineering (CE) program comprises a total of 160 credits and 201 contact hours and 06 weeks of fieldwork and internship. A student of this program can specialize in seven (05) different subjects, such as structural engineering, geotechnical engineering, water resource engineering, transportation engineering, and environmental engineering.

3.2 Vision and Mission of the Program

Vision:

To become a recognized leader in producing highly competent civil engineers by imparting quality education, promoting useful research and striving to induce social responsibilities, ethical values and leadership to enhance quality of life for people of the nation and the world.

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Mission:

MD 1 To provide a high-quality learning environment for students in both undergraduate and postgraduate levels through a broad-based, rigorous curriculum, emphasizing theoretical and practical concepts to gain fundamental and specialized engineering knowledge, while they develop skills in critical thinking, communication, leadership, and lifelong learning.

MD 2 To create opportunities for students and faculty to conduct basic and applied research that contributes to society by advancing sustainable engineering principles and practices.

MD 3 To provide civil engineering leadership and service to the nation, the profession, and society at large with strong professional values, and disciplined work ethics**.**

3.3 Program Educational Objectives (PEOs)

No	PEO Statement
PEO-1	Graduates of Civil Engineering will develop a sound background in fundamental science and engineering principles as applied to civil engineering for a successful professional career.
PEO-2	Graduates of Civil Engineering acquire skills and abilities to excel in the area of civil engineering both in industries and academics.
PEO-3	Graduates of Civil Engineering will understand sustainable engineering practices, Socio-ethical values and life-long learning.
PEO-4	Graduates of Civil Engineering possess awareness towards higher education, research & development and play a role to the leadership.

3.4 Program Outcomes (POs)

Program Outcomes (POs) represent the knowledge, skills and attitudes the students should have at the end of a four-year engineering program. Based on the suggestion of Board of Accreditation for Engineering and Technical Education (BAETE), Bangladesh, the Nuclear Engineering (NE) program has following 12 Program Outcomes:

PO1 Engineering knowledge: Apply the knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization (**WK1, WK2, WK3, WK4**) to the solution of complex Civil engineering problems.

PO2 Problem analysis: Able to identify, formulate, research literature and analyze complex Civil engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (**WK1, WK2, WK3, WK4**).

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

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

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)**.

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

PO7 Environment and sustainability: Able to understand and evaluate the sustainability and impact of professional engineering work in the solution of complex Civil engineering problems in societal and environmental contexts **(WK7)**.

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

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.

PO10 Communication: Able to communicate effectively about complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports, design documentation, make effective presentations, and give and receive clear instructions.

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

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

3.5 Bloom's Taxonomy

Bloom's Taxonomy is a classification system used to define and distinguish different levels of human cognition i.e., thinking, learning, and understanding. Typically, Bloom's Taxonomy is used to inform or guide the development of Assessments (tests and other evaluations of student learning), Curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies. There are three learning domains of Bloom's Taxonomy.

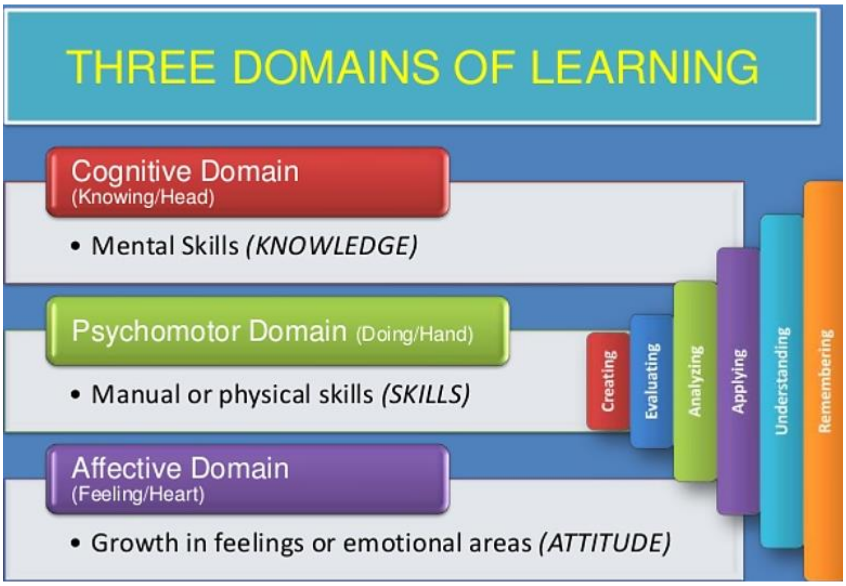


Figure 3.1: The Learning Domains of Bloom's Taxonomy (OBE Based Curriculam UGC 2020)

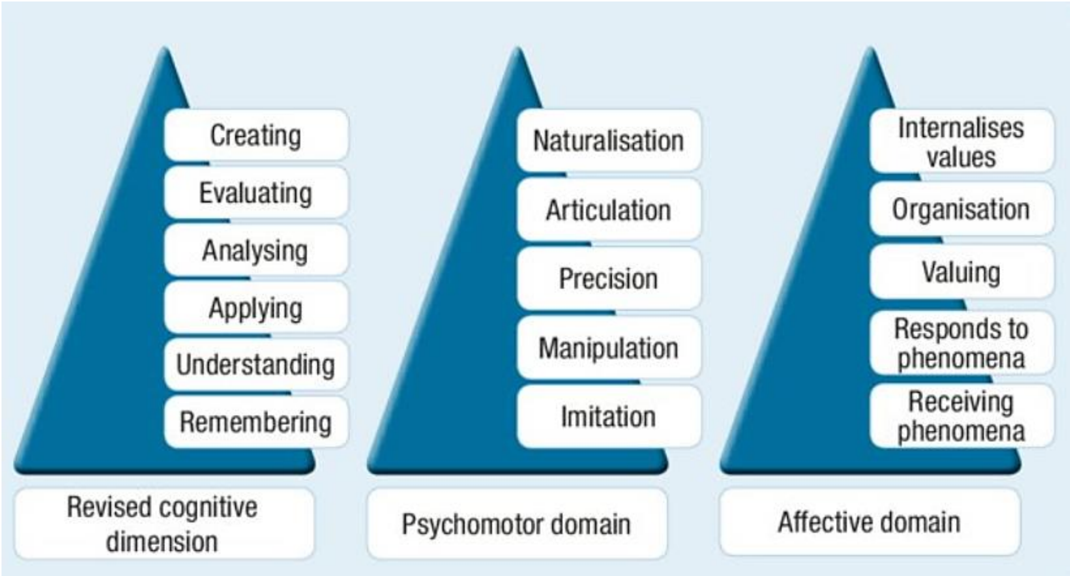


Figure 3.2: Three Domains of Bloom's Taxonomy (OBE Based Curriculam UGC 2020)

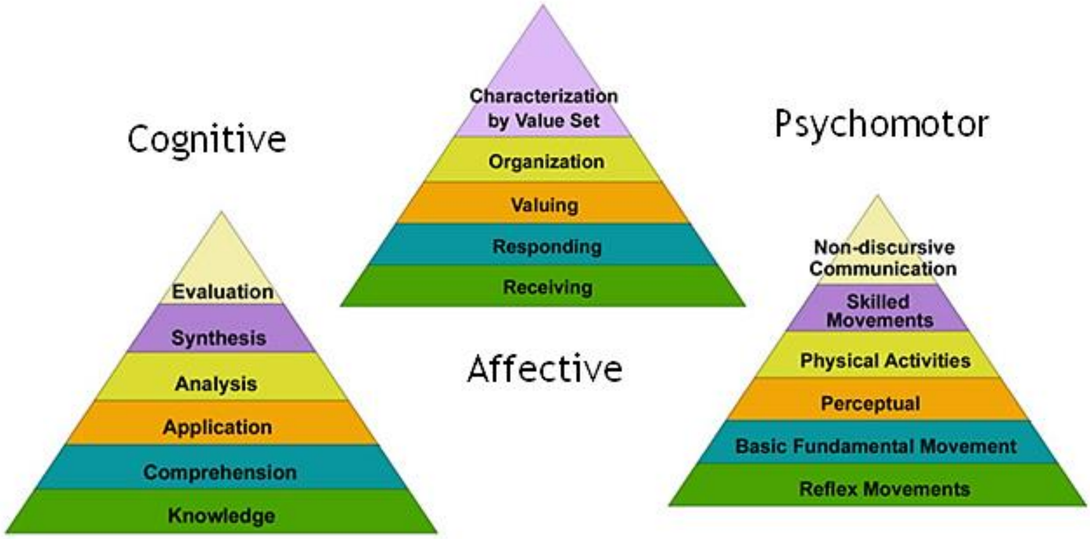


Figure 3.3: Levels of three Domains of Bloom's Taxonomy (OBE Based Curriculam UGC 2020)

3.6 Washington Accord

The graduate attributes adopted by the Washington Accord signatories are generic to the education of professional engineers in all engineering disciplines. They categorise what graduates should know, the skills they should demonstrate and the attitudes they should possess. The Washington Accord Graduate Attribute Profile has 12 elements, supported by a Knowledge Profile, WK1-WK8, and a definition of the Level of Problem Solving, WP1-WP7, which given below:

3.6.1 Knowledge Profiles (WK1 to WK8)

The Washington Accord Knowledge Profile has eight elements:

WK1: A systematic, theory-based understanding of the **natural sciences** applicable to the discipline.

WK2: Conceptually-based **mathematics**, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modeling applicable to the discipline.

WK3: A systematic, theory-based formulation of **engineering fundamentals** required in the engineering discipline.

WK4: Engineering **specialist knowledge** that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge that supports **engineering design** in a practice area.

WK6: Knowledge of **engineering practice** (technology) in the practice areas in the engineering discipline.

WK7: Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability.

WK8: Engagement with selected knowledge in the **research literature** of the discipline.

3.6.2 Range of Problem Solving

Complex Engineering Problems have characteristic WP1 and some or all of WP2 to WP7:

WP1 Depth of Knowledge Required: Cannot be resolved without in-depth engineering knowledge at the level of one or more of WK3, WK4, WK5, WK6 or WK8 which allows a fundamentals-based, first principles analytical approach.

WP2 Range of conflicting requirements: Involve wide-ranging or conflicting technical, engineering and other issues.

WP3 Depth of analysis required: Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models.

WP4 Familiarity of issues: Involve infrequently encountered issues.

WP5 Extent of applicable codes: Are outside problems encompassed by standards and codes of practice for professional engineering.

WP6 Extent of stakeholder involvement and conflicting requirements: Involve diverse groups of stakeholders with widely varying needs.

WP7 Interdependence: Are high level problems including many component parts or sub-problems.

3.6.3 Range of Engineering Activities

Complex activities mean activities or projects that have some or all of the following characteristics:

EA1 Range of resources: Involve the use of diverse resources (and for this purpose resources includes people, money, equipment, materials, information and technologies)

EA2 Level of interactions: Require resolution of significant problems arising from interactions between wide ranging or conflicting technical, engineering or other issues

EA3 Innovation: Involve creative use of engineering principles and research-based knowledge in novel ways

EA4 Consequences to society and the environment: Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation

EA5 Familiarity: Can extend beyond previous experiences by applying principles-based approaches.

3.7 Relationship/Mapping between Mission of the Dept and the Institute

No.	Mission statement of CE	Mission of MIST			
		Mission statement 1	Mission statement 2	Mission statement 3	Mission statement 4
1	Provide a high-quality learning environment for students in both undergraduate and postgraduate levels through a broad-based, rigorous curriculum, emphasizing theoretical and practical concepts to gain fundamental and specialized engineering knowledge, while they develop skills in critical thinking, communication, leadership and lifelong learning.	Yes	Yes	No	No
2	Create opportunities for students and faculty to conduct basic and applied research that contributes to society by advancing sustainable engineering principles and practices.	No	Yes	Yes	Yes

3	Provide civil engineering leadership and service to the nation, the profession and society at large with strong professional values, and disciplined work ethics.	No	Yes	Yes	No

3.8 Relationship/Mapping between PEO and Mission of the Dept

No.	Program Educational Objectives (PEOs)	Mission of CE Dept		
		Mission statement 1	Mission statement 2	Mission statement 3
1	Graduates of CE will develop a sound background in fundamental science and engineering principles as applied to civil engineering for a successful professional career.	Yes	No	Yes
2	Graduates of CE acquire skills and abilities to excel in the area of civil engineering both in industries and academics.	Yes	Yes	No
3	Graduates of CE will understand sustainable engineering practices, Socio-ethical values and life-long learning.	No	Yes	Yes
4	Graduates of CE possess awareness towards higher education, research & development and play a role to the leadership	Yes	Yes	No

3.9 Relation between PEOs and POs

No.	PO statement	PEO 1	PEO 2	PEO 3	PEO 4
1	**Engineering knowledge:** Apply the knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization (WK1, WK2, WK3, WK4) to the solution of complex Civil engineering problems	Yes	No	No	No

2	**Problem analysis:** Able to identify, formulate, research literature and analyze complex Civil engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (WK1, WK2, WK3, WK4)	Yes	No	No	Yes
3	**Design/development of solutions:** Able to design solutions for complex Civil engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental concerns **(WK5)**.	Yes	No	No	No
4	**Investigation:** Able to conduct investigations of complex Civil Engineering problems using research-based knowledge **(WK8)** and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions	Yes	No	No	No
5	**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)**	Yes	Yes	No	No
6	**The engineer and society:** Able to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex Civil engineering problems **(WK7)**	No	No	Yes	No
7	**Environment and sustainability:** Able to understand and evaluate the sustainability and impact of professional engineering work in the solution of complex Civil engineering problems in societal and environmental contexts **(WK7)**	No	No	Yes	No
8	**Ethics:** Able to apply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice **(WK7)**	No	No	Yes	No
9	**Individual work and teamwork:** Able to function effectively as an individual, and as a	No	No	No	Yes

	member or leader of diverse teams and in multi-disciplinary settings				
10	**Communication:** Able to communicate effectively about complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports, design documentation, make effective presentations, and give and receive clear instructions	No	Yes	No	Yes
11	**Project management and finance:** Able to demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's work as a member or leader in a team, to manage projects and in multidisciplinary environments	No	No	Yes	No
12	**Life-long learning:** Able to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	No	No	Yes	Yes

3.10 <u>Course Outcomes (COs):</u>

The Course Outcomes (CO) are the resultant knowledge skills the student acquires at the end of a course. It defines the cognitive processes a course provides. Chapter 5 and 6 contain the detailed Learning Outcomes for each of the courses under the heading of Learning Outcomes (LOs).

3.11 <u>Generic Skills</u>

The graduates of the NE program are expected to have the following generic skills:

a. Ability to apply the principles and theory of nuclear engineering knowledge to the requirements, design and development of different nuclear systems with appropriate understanding.

b. Ability to define and use appropriate research methods and modern engineering tools.

c. Ability to apply critical thinking to solve complex engineering problems and design innovative solutions.

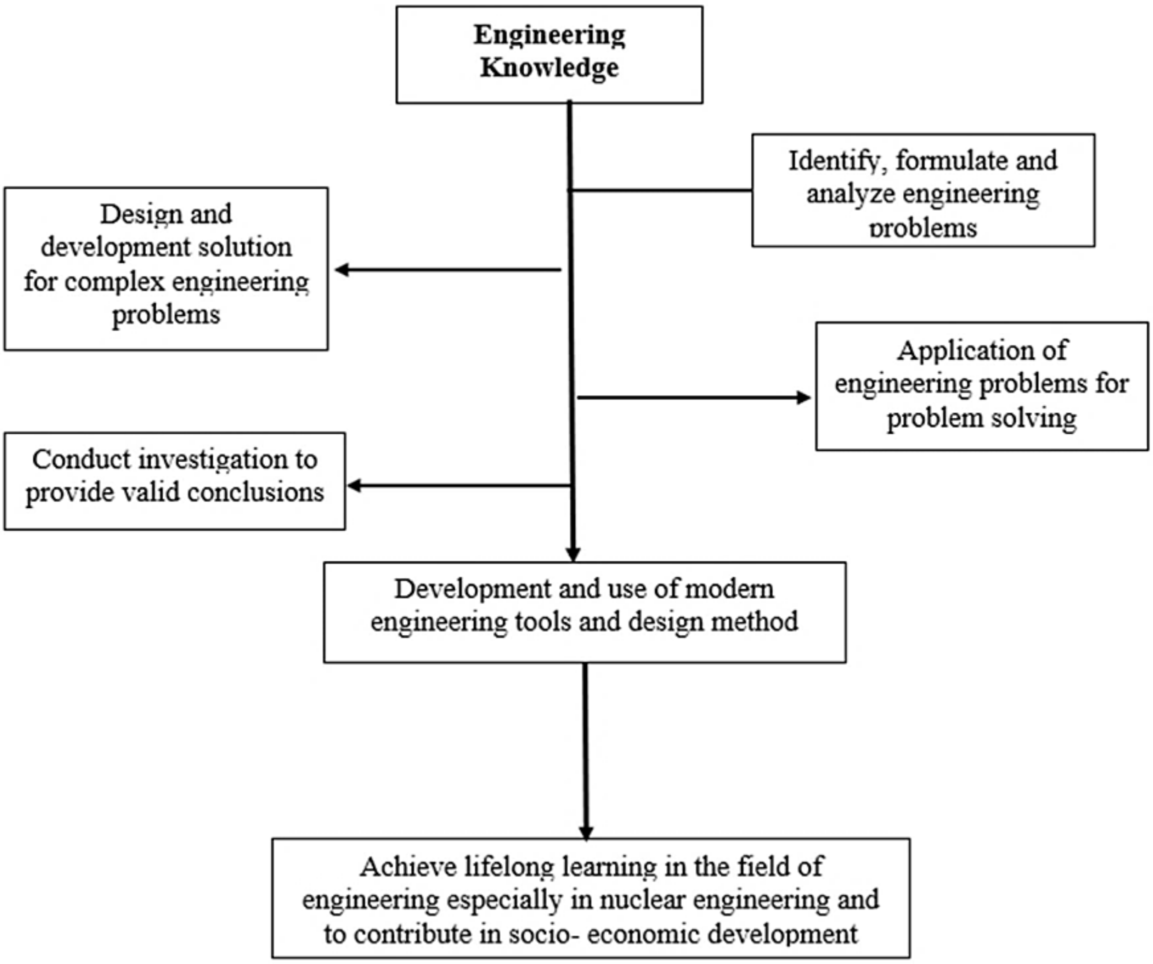
d. Ability to learn independently, be self- aware and self- manage their time and workload.

e. Ability to analyze real time problems and justify the appropriate use of technology.

f. Ability to work effectively as an individual, and as a member or leader of a team in diverse situations and exhibit social responsibility.

3.12 <u>Curriculum/ Skill Mapping</u>

The courses of CE program are designed in such a way that the corresponding Course Outcomes (COs) contribute to the 12 Program Outcomes (POs) which eventually achieves the mission and vision of the program. Chapter 5 and 6 contain the mapping for each of the courses**.** However, generic curriculum/ skill mapping is shown below:



CHAPTER 4

COURSE CURRICULUM FOR BACHELOR DEGREE IN CE

4.1 Introduction

Keeping the above-mentioned program outcome, the following courses are offered for the undergraduate students of Civil Engineering (CE) Program offered by the Department of Civil Engineering.

4.2 List of Language, General Education, Mathematics, Basic Science, and Interdisciplinary Courses

Basic Science

SL.	Course Code	Course Name	Level-Term	Cr. Hr.	Ct. Hr.
1	PHY 101	Waves and Oscillation, Optics, and Modern Physics	1-I	3	3
2	CHEM 101	Fundamentals of Chemistry	1-I	3	3
3	PHY 107	Structure of Matter, Heat and Temperature, Kinetics and Kinematics	1-II	3	3
4	CHEM 105	Environmental Chemistry	1-II	3	3
5	PHY 102	Physics Sessional	1-II	1.5	3
6	CHEM 102	Chemistry Sessional	1-I	1.5	3

Mathematics

SL.	Course Code	Course Name	Level-Term	Cr. Hr.	Ct. Hr.
1	MATH 101	Diffrential and Integral Calculus	1-I	3	3
2	MATH 103	Differential Equations and Matrix	1-II	3	3
3	MATH 201	Vector Analysis, Laplace Transform and Coordinate Geometry	2-I	3	3
4	MATH 203	Applied Mathematics for Engineers	2-II	3	3

General Education

SL.	Course Code	Course Name	Level-Term	Cr. Hr.	Ct. Hr.
1	GEBS101	Bangladesh Studies	1-I	2	4
2	GES 101	Fundamentals of Sociology	1-II	2	2
3	GEA 201	Principles of Accounting	2-I	2	2
4	GEE 201	Fundamentals of Economics	2-I	2	2
5	GELM 275	Leadership and Management	2-II	2	2
6	GERM 352	Fundamentals of Research Methodology	3-I	2	4
7	GEPM 401	Project Planing and Construction Management	4-II	3	3
8	GEEP 403	Engineering Ethics and Professional Practices	4-II	2	2

Language

SL.	Course Code	Course Name	Level-Term	Cr. Hr.	Ct. Hr.
1	LANG 102	Communicative English I	1-I	1.5	3
2	LANG 202	Communicative English II	2-I	1.5	3

Interdisciplinary

SL.	Course Code	Course Name	Level-Term	Cr. Hr.	Ct. Hr.
1	CSE 176	Computer Programming Sessional	1-I	1.5	3
2	ME 132	Workshop Technology Sessional	1-I	1.5	3
3	EECE 165	Basic Electrical Technology	1-II	3	3
4	CSE 274	Engineering Computations Sessional	2-II	1.5	3
5	ARCH 214	Architechtural, Engineering and Planning Appreciation	2-II	1.5	3

4.3 List of Core Courses

SL.	Course Code	Course Name	Level-Term	Cr. Hr.	Ct. Hr.
1	CE 100	Civil Engineering Drawing	1-I	1.5	3
2	CE 101	Analytical Mechanics	1-I	3	3
3	CE 103	Surveying and Spatial Information Engineering	1-Il	3	3
4	CE 102	Computer Aided Drawing	1-Il	1.5	3
5	CE 104	Practical Surveying	1-Il	1.5	3 weeks
6	CE 211	Mechanics of Solids I	2-I	3	3
7	CE 261	Fluid Mechanics	2-I	3	3
8	CE 203	Engineering Geology and Geomorphology	2-I	3	3
9	CE 200	Details of Construction	2-I	1.5	3
10	CE 210	GIS and Remote sensing	2-I	1.5	3
11	CE 262	Fluid Mechanics Sessional	2-I	1.5	3
12	CE 201	Engineering Materials	2-II	3	3
13	CE 205	Numerical Methods for Engineering	2-II	3	3
14	CE 213	Mechanics of Solids II	2-II	3	3
15	CE 208	Quantity Surveying	2-II	1.5	3
16	CE 212	Structural Mechanics and Materials Sessional	2-II	1.5	3
17	CE 311	Structural Analysis and Design I	3-I	4	4
18	CE 315	Design of Concrete Structures I	3-I	3	3
19	CE 331	Environmental Engineering I	3-I	3	3
20	CE 341	Principle of Soil Mechanics	3-I	4	4
21	CE 332	Environmental Engineering Sessional	3-I	1.5	3

22	CE 342	Geotechnical Engineering Sessional	3-I	1.5	3
23	CE 317	Design of Concrete Structures II	3-II	3	3
24	CE 333	Environmental Engineering II	3-I	4	4
25	CE 343	Foundation Engineering	3-II	3	3
26	CE 351	Fundamentals of Transportation Engineering	3-II	3	3
27	CE 361	Open Channel Hydraulics	3-II	3	3
28	CE 316	Concrete Structures Design Sessional I	3-II	1.5	3
29	CE 362	Open Channel Hydraulics Sessional	3-II	1.5	3
30	CE 300	Civil Engineering Students' Internship Programme (CESIP)	3-II	1.5	3 wks
31	CE 411	Structural Analysis and Design II	4-I	3	3
32	CE 413	Design of Steel Structures	4-I	3	3
33	CE 451	Highway Materials, Pavement Design and Railways	4-I	4	4
34	CE 463	Hydrology and Irrigation Engineering	4-I	4	4
35	CE 410	Concrete Structures Design Sessional II	4-I	1.5	3
36	CE 414	Steel Structures Design Sessional	4-I	1.5	3
37	CE 452	Highway Materials, Mix Design and Traffic Engineering Sessional	4-I	1.5	3
38	CE 400	Final Year Research Project	4-I & II	6	12

4.4 List of Elective Courses

Structural Engineering

SL.	Course Code	Course Name	Level-Term	Cr. Hr.	Ct. Hr.
1	CE 412	Bridge Design Sessional	4-II	1.5	3
2	CE 415	Prestressed Concrete	4-II	2	2

3	CE 417	Design of Concrete Structures III	4-II	2	2
4	CE 419	Introduction to Finite Element Method	4-II	2	2
5	CE 421	Dynamics of Structures	4-II	2	2
6	CE 423	Structural Safety	4-II	2	2
7	CE 425	Seismic Design of Structures	4-II	2	2
8	CE 427	Advanced Solid Mechanics	4-II	2	2
9	CE 429	Design of Steel-Concrete Composite Structure	4-II	2	2

Environmental Engineering

SL.	Course Code	Course Name	Level-Term	Cr. Hr.	Ct. Hr.
1	CE 431	Natural Resources and Renewable Energy	4-II	2	2
2	CE 433	Solid and Hazardous Waste Management	4-II	2	2
3	CE 435	Environmental Pollution and Management	4-II	2	2
4	CE 437	Climate Change and Disaster Management	4-II	2	2
5	CE 439	Environmental Impact Assessment and Sustainability	4-II	2	2
6	CE 432	Design of Water Supply, Sanitation and Sewerage Systems	4-II	1.5	3

Geotechnical Engineering

SL.	Course Code	Course Name	Level-Term	Cr. Hr.	Ct. Hr.
1	CE 443	Earth Retaining Structures	4-II	2	2
2	CE 445	Elementary Soil Dynamics	4-II	2	2
3	CE 447	Soil-Water Interaction	4-II	2	2
4	CE 449	Numerical Methods in Geotechnics	4-II	2	2
5	CE 442	Foundation Design Sessional	4-II	1.5	3

Transportation Engineering

SL.	Course Code	Course Name	Level-Term	Cr. Hr.	Ct. Hr.
1	CE 453	Traffic Engineering Design and Management	4-II	**2**	**2**
2	CE 455	Pavement Management, Drainage and Airport Engineering	4-II	**2**	**2**
3	CE 457	Urban Transportation Planning & Management	4-II	**2**	**2**
4	CE 459	Intelligent Transportation System	4-II	**2**	**2**
5	CE 461	Railway Engineering	4-II	**2**	**2**
6	CE 454	Traffic Studies and Pavement Design Sessional	4-II	**1.5**	**3**

Water Resource Engineering

SL.	Course Code	Course Name	Level-Term	Cr. Hr.	Ct. Hr.
1	CE 465	Groundwater Engineering	4-II	2	2
2	CE 467	Flood Mitigation and Management	4-II	2	2
3	CE 469	River Engineering	4-II	2	2
4	CE 471	Hydraulic Structures	4-II	2	2
5	CE 473	Coastal Engineering	4-II	2	2
6	CE 472	Hydraulic Structures Design Sessional	4-II	1.5	3

4.5 Term Wise Distribution of Courses for B.Sc. Engg. in Civil Engineering (CE)

Level – 1, Term – I

SL.	Course Code	Course Name	Cr. Hr.	Ct. Hr.	Type
1	CE 101	Analytical Mechanics	3.0	3	T
2	PHY 101	Waves and Oscillation, Optics and Modern Physics	3.0	3	T

3	CHEM 101	Fundamentals of Chemistry	3.0	3	T
4	MATH 101	Differential and Integral Calculus	3.0	3	T
5	GEBS 101	Bangladesh Studies	2.0	2	T
6	CE 100	Civil Engineering Drawing	1.5	3	S
7	CSE 176	Computer Programming Sessional	1.5	3	S
8	ME 132	Workshop Technology Sessional	1.5	3	S
9	CHEM 102	Chemistry Sessional	1.5	3	S
Total [Theory (T) – 5, Sessional (S) – 4]			20	26	

Level – 1, Term – II

SL.	Course Code	Course Name	Cr. Hr.	Ct. Hr.	Type
1	CE 103	Surveying and Spatial Information Engineering	3.0	3	T
2	EECE 165	Basic Electrical Technology	3.0	3	T
3	PHY 107/ CHEM 105	Structure of Matter, Heat and Temperature, Kinetics and Kinematics/ Environmental Chemistry	3.0	3	T
4	MATH 103	Differential Equations and Matrix	3.0	3	T
5	GES 101	Fundamentals of Sociology	2.0	2	T
6	CE 102	Computer Aided Drawing	1.5	3	S
7	PHY 102	Physics Sessoinal	1.5	3	S
8	LANG 102	Communicative English I	1.5	3	S
9	CE 104	Practical Surveying	1.5	3 wks	S
Total [Theory (T) – 5, Sessional (S) – 3, Survey]			20	23	

Level – 2, Term – I

SL.	Course Code	Course Name	Cr. Hr.	Ct. Hr.	Type
1	CE 211	Mechanics of Solids I	3.0	3	T

2	CE 261	Fluid Mechanics	3.0	3	T
3	CE 203	Engineering Geology and Geomorphology	3.0	3	T
4	MATH 201	Vector Analysis, Laplace Transform and Coordinate Geometry	3.0	3	T
5	GEA 201/ GEE 201	Principles of Accounting/ Fundamentals of Economics	2.0	2	T
6	CE 200	Details of Construction	1.5	3	S
7	CE 210	GIS and Remote Sensing	1.5	3	S
8	CE 262	Fluid Mechanics Sessional	1.5	3	S
9	LANG 202	Communicative English II	1.5	3	S
Total [Theory (T) – 5, Sessional (S) – 4]			20	26	

Level – 2, Term – II

SL.	Course Code	Course Name	Cr. Hr.	Ct. Hr.	Type
1	CE 201	Engineering Materials	3.0	3	T
2	CE 205	Numerical Methods for Engineering	3.0	3	T
3	CE 213	Mechanics of Solids II	3.0	3	T
4	MATH 203	Applied Mathematics for Engineers	3.0	3	T
5	GELM 275	Leadership and Management	2.0	2	T
6	CE 208	Quantity Surveying	1.5	3	S
7	CE 212	Structural Mechanics and Materials Sessional	1.5	3	S
8	CSE 274	Engineering Computations Sessional	1.5	3	S
9	ARCH 214	Architectural, Engineering and Planning Appreciation	1.5	3	S
Total [Theory (T) – 5, Sessional (S) – 4]			20	26	

Level – 3, Term – I

SL.	Course Code	Course Name	Cr. Hr.	Ct. Hr.	Type
1	CE 311	Structural Analysis and Design I	4.0	4	T

2	CE 315	Design of Concrete Structures I	3.0	3	T
3	CE 331	Environmental Engineering I	3.0	3	T
4	CE 341	Principles of Soil Mechanics	4.0	4	T
5	CE 332	Environmental Engineering Sessional	1.5	3	S
6	CE 342	Geotechnical Engineering Sessional	1.5	3	S
7	GERM 352	Fundamentals of Research Methodology	2.0	4	S
Total [Theory (T) – 4, Sessional (S) – 3]			19	24	

Level – 3, Term – II

SL.	Course Code	Course Name	Cr. Hr.	Ct. Hr.	Type
1	CE 317	Design of Concrete Structures II	3.0	3	T
2	CE 333	Environmental Engineering II	4.0	4	T
3	CE 343	Foundation Engineering	3.0	3	T
4	CE 351	Fundamentals of Transportation Engineering	3.0	3	T
5	CE 361	Open Channel Hydraulics	3.0	3	T
6	CE 316	Concrete Structures Design Sessional I	1.5	3	S
7	CE 362	Open Channel Hydraulics Sessional	1.5	3	S
8	CE 300	Civil Engineering Students' Internship Programme (CESIP)	1.5	3 wks	-
Total [Theory (T) – 5, Sessional (S) – 2, CESIP]			20.5	22	

Level – 4, Term – I

SL.	Course Code	Course Name	Cr. Hr.	Ct. Hr.	Type
1	CE 411	Structural Analysis and Design II	3.0	3	T
2	CE 413	Design of Steel Structures	3.0	3	T
3	CE 451	Highway Materials, Pavement Design and Railways	4.0	4	T
4	CE 463	Hydrology and Irrigation Engineering	4.0	4	T
5	CE 410	Concrete Structures Design Sessional II	1.5	3	S

6	CE 414	Steel Structures Design Sessional	1.5	3	S
7	CE 452	Highway Materials, Mix Design and Traffic Engineering Sessional	1.5	3	S
8	CE 400	Final Year Research Project (FYP)	2.0	4	-
Total [Theory (T) – 4, Sessional (S)– 3, FYP]			20.5	23	

Level – 4, Term – II

SL.	Course Code	Course Name	Cr. Hr.	Ct. Hr.	Type
1	CE 4XX	Two Theory Courses in Major Division from Elective Courses	4.0	4	T
2	CE 4XX	Two Theory Courses in Minor Division from Elective Courses	4.0	4	T
3	GEPM 401	Project Planning and Construction Management	3.0	3	T
4	GEEP 403	Engineering Ethics and Professional Practices	2.0	2	T
5	CE 4XX	One Lab Course in Major Division from Elective Courses	1.5	3	S
6	CE 4XX	One Lab Course in Minor Division from Elective Courses	1.5	3	S
7	CE 400	Final Year Research Project (FYP) from Elective Courses	4.0	8	-
Total [Theory (T) – 6, Sessional (S) – 3, FYP]			20	27	

4.6 Summary of Credit Distribution - Level and Termwise

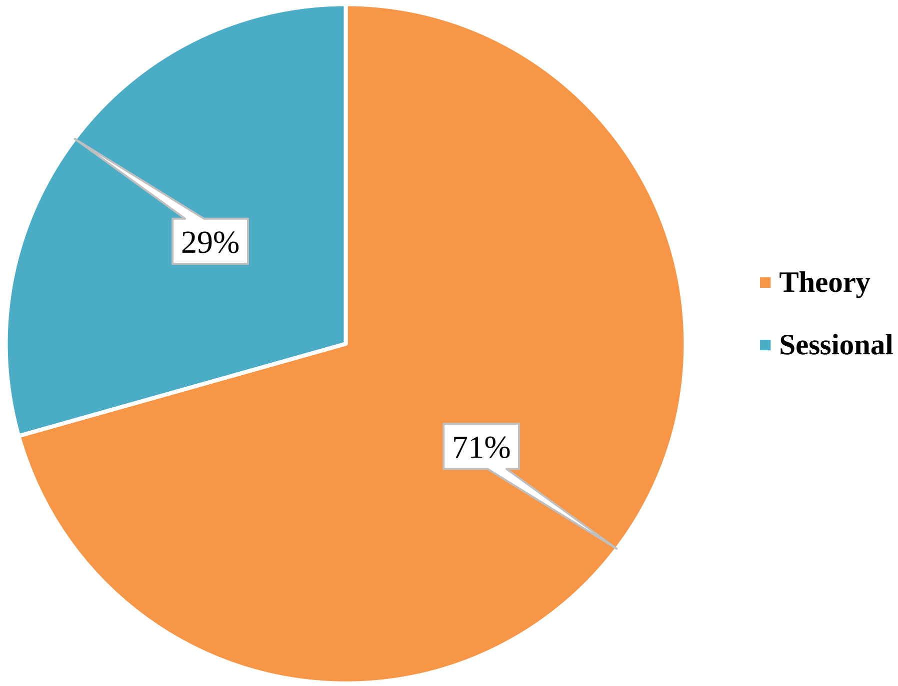
Level-Term	Contact Hours for Theory Courses	Contact Hours for Sessional Courses	Total Credit Hours	Total Contact Hours
1-I	14	12	20	26
1-II	14	9+3 wks (Survey)	20	23+3 wks (Survey)
2-I	14	12	20	26
2-II	14	12	20	26

3-I	14	10	19	24
3-II	16	6+3 wks (CESIP)	20.5	22 + 3 wks (CESIP)
4-I	14	9+4 hr. (FYP)	20.5	23+4 hr. (FYP)
4-II	13	6+8 hr. (FYP)	20	19+8 hr. (FYP)
Total	111	92 + 6 wks	160	201 + 6 wks

4.7 Summary of Theory and Sessional Courses- Level and Termwise

Level and Term	**Hours/Week**		**Total Ct Hours**	**Credits**		**Total Credit**	**No. of Courses**	
	Theory	**Sessional**		**Theory**	**Sessional**		**Theory**	**Sessional**
Level-1 Term-I	14	12	26	14	6	20	5	4
Level-1 Term-II	14	9+3 wks	23+3 wks	14	4.5+1.5 Survey	20	5	3+Survey
Level-2 Term-I	14	12	26	14	6	20	5	4
Level-2 Term-II	14	12	26	14	6	20	5	4
Level-3 Term-I	14	10	24	14	5	19	4	3
Level-3 Term-II	16	6+3 wks	22 + 3 wks	16	3+1.5 CESIP	20.5	5	2+CESIP
Level-4 Term-I	14	13	27	14	4.5+2 FYP	20.5	4	3+FYP
Level-4 Term-II	13	14	27	13	3+4 FYP	20	6	2+FYP
Grand Total	113	88 + 6 wks	201+ 6 wks	113	47	160	39	25 + Survey + CESIP + FYP

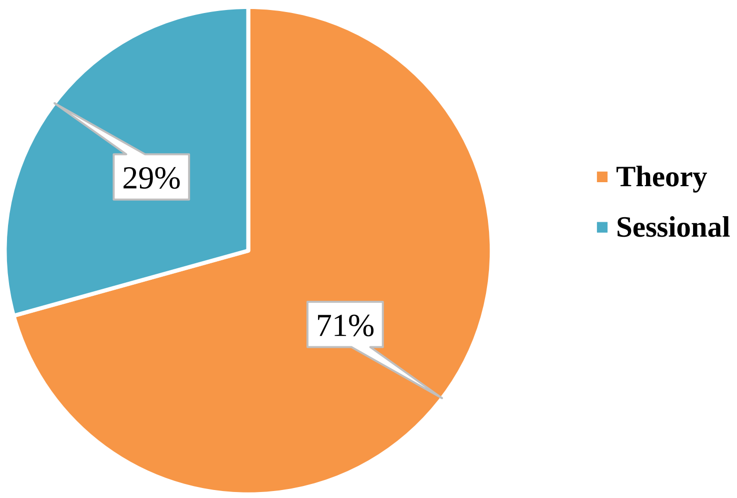
Overall Theory and Sessional Credit Hours Ratio



4.8 Summary of Departmental Theory and Sessional Courses - Level and Termwise Credit Hours

Level/ Term	Theory	Sessional	Total
Level-1 Term-I	3.0	1.5	4.5
Level-1 Term-II	3.0	1.5	4.5
Level-2 Term-I	9.0	4.5	13.5
Level-2 Term-II	9.0	3.0	12.0
Level-3 Term-I	14.0	3.0	17.0
Level-3 Term-II	16.0	3+1.5 CESIP	20.5
Level-4 Term-I	14.0	4.5+2 FYP	20.5
Level-4 Term-II	8.0	3+4 FYP	15
Total	**76.0**	**31.50**	**107.50**

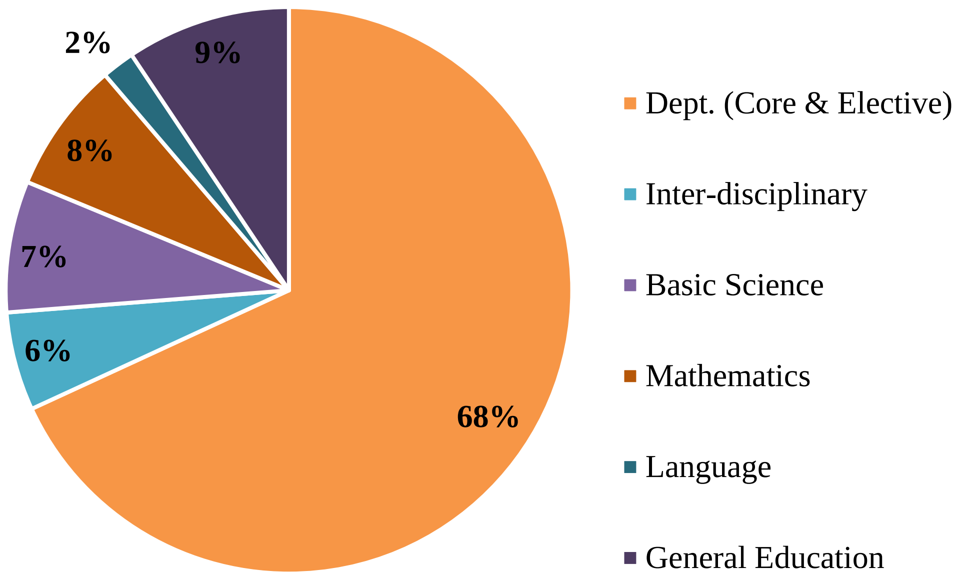
Departmental Theory and Sessional Credit Hours Ratio



4.9 <u>Summary of Credit Hours for Departmental (core and elective), Inter-disciplinary, Basic Science. Mathematics, and General Education Courses</u>

Level/ Term	Dept. (Core & Elective)	Inter-disciplinary	Basic Science	Mathematics	Language	General Education	Total
Level-1 Term-I	4.5	3	7.5	3	-	2	**20**
Level-1 Term-II	6	3	4.5	3	1.5	2	**20**
Level-2 Term-I	13.5	-	-	3	1.5	2	**20**
Level-2 Term-II	12	3	-	3	-	2	**20**
Level-3 Term-I	17	-	-	-	-	2	**19**
Level-3 Term-II	20.5	-	-	-	-	-	**20.5**
Level-4 Term-I	20.5	-	-	-	-	-	**20.5**
Level-4 Term-II	15	-	-	-	-	5	**20**
Total	109	9	12	12	3	15	160
% of Courses	**68.1%**	**5.6%**	**7.5%**	**7.5%**	**1.9%**	**9.4%**	**100.00%**

Percentage of of Credit Hours for Departmental (Core & Elective), Interdisciplinary, Basic Science, and General Education Courses



4.10 <u>Teaching Strategy</u>

Multiple teaching and learning activities are necessary to achieve the intended outcomes, since students have different learning styles. It is therefore, the CE department planned to choose appropriate teaching and learning methods that will foster student's engagement in the learning process rather than students listening to the lectures passively. Student centred learning is about active participation of students in the classroom, and that active participation will be achieved by content/curriculum, teacher's interaction with the students and the environment that are directed towards students learning. The strategy includes:

a. **<u>Face-to-Face Learning</u>**

- Lecture /Presentation/ Discussion
- Practical / Tutorial / Studio
- Case Studies
- Assignment/Quiz
- Group discussion/projects
- Design and Research

b. **<u>Self-Directed Learning</u>**

- Non-face-to-face learning

- Revision
- Preparation of presentation
- Preparation of Lab Reports
- Preparation of Lab Test
- Engagement in Group Projects
- Preparation of Assignment/Quiz
- Preparation for final Examination

Details of teaching strategy for each of the courses under the heading of Teaching Learning Strategy is given in Chapter 5 and 6.

4.11 <u>Assesment Strategy</u>

Assessment of student achievement is an important aspect of Outcome-based education. Students will be assessed both directly and indirectly. Direct Assessment includes class tests, assignments, and Mid and Term final examinations. However, appropriate rubrics have been set to evaluate indirect assessment. Assessment process is aligned with the learning outcomes. Assessment supports the learners in their progress and validates the achievement of the intended learning outcomes at the end of the lecture/course/module. Assessment methods are adapted depending on the kind of outcomes that are aimed to be achived. The assessment strategy is given below:

a. <u>Theory Based Courses</u>

SL.	**Components**		**Grading**
1	Continuous Assessment (40%)	Class Attendance	05%
		Class Performance	05%
		Class Test/ Assignment	20%
		Mid-term Exam/ Project	10%
2	Final Examination		60%
	Total Marks		**100%**

b. <u>Sessional Courses</u>

The CE department offers different types of sessional courses which include laboratory investigations, design through use of modern tools and softwares, field survey, drawing etc. Thereby assessments vary depending on selected course. The following represents a typical assessment strategy for a regular sessional course-

SL.	Components		Grading
1	**Continuous Assessment (60%)**	Class Attendance	05%
		Conduct of Lab Test	20%
		Report Writing	15%
		Mid-term	20%
2	**Final Evaluation (40%)**	Exam	30%
		Viva Voce/ Presentation	10%
	Total Marks		100%

Details of assessment strategy for each of the courses under the heading of assessment Strategy is given in Chapter 5.

CHAPTER 5

5.1 Basic Sciences (Physics and Chemistry)

Physics

Spring Semester: Level 1 Term I

COURSE INFORMATION			
Course Code Course Title	: PHY 101 : Waves and Oscillations, Optics and Modern Physics	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This is a course for basic physics covering the field of Waves and Oscillations, Optics and Modern physics. The course emphasizes basic concepts, theories and solveing quantitative problems which can be applied in a wide spectrum of engineering disciplines.			
OBJECTIVE			
• To understand the different parameter and concepts of Waves and Oscillations, Optics and Modern physics. • To comprehend the basic theories of Waves and Oscillations, Optics and Modern physics. • To solve numerical problems regarding Waves and Oscillations, Optics and Modern physics.			
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 progressive wave, 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.

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	Be able to **Define** the different parameters 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.	√											
2	Be capable to **Explain** the wave motion for different systems along with energy, the techniques to derive different formula for interference, diffraction, polarization and prism, different theory regarding modern physics such as special theory of relativity, Compton theory, materials according to magnetic properties, nuclear transformation, and nuclear reaction etc.	√											

3	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.	√											

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Be able to **Define** the different parameters 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.	1	C1	-	-	1	Quiz, Mid Term examination, Final Exam
CO2	Be capable to **Explain** the wave motion for different systems along with energy, the techniques to derive different formula for interference, diffraction,	1	C1	-	-	1	Mid Term examination, Final Exam

	polarization and prism, different theory regarding modern physics such as special theory of relativity, Compton theory, materials according to magnetic properties, nuclear transformation, and nuclear reaction etc.						
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.	1	C2	-	-	2	Class Assessment, Quiz, Mid Term examination, 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) Class assessment (2 hours/14 weeks)	 42 2
Guided Learning Tutorials/Assignment Preparation	 09
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for test and examination	84 14

Assessment Pop quiz/ Class Test/Mid-Term Examination Final Examination	04 05
Total	160

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lectures	Topics	Assessments
1	1	Introductory class: Brief discussion on total syllabus, basic requirements of the course, assessment of the course	CT/ Assignment
	2	Simple harmonic motion (SHM) and its differential equations, graphical representation of SHM	
	3	Average K.E and total energy	
2	4	Spring-mass system, electric oscillatory circuit	
	5	Simple, compound and torsional pendulum	
	6	Combination of two SHM	
3	7	Combination of two SHM	
	8	Two body oscillations, reduced mass	
	9	Damped oscillations and its differential equation	
4	10	Displacement equation of damped oscillation, electric damped oscillatory circuit	CT/ Assignment
	11	Forced oscillation and its differential equation	
	12	Displacement equation of forced oscillation, resonance	
5	13	Plane progressive wave, energy density of wave	
	14	Stationary wave	
	15	Lens and combination of lenses, power of lens	
6	16	defects of images and different aberrations	Mid Term/ Assignment
	17	defects of images and different aberrations	

	18	Interference of light, young's double slit experiment	
7	19	Interference in Thin films, Newton's ring	
	20	Diffraction: Fresnel & Fraunhofer diffraction	
	21	Diffraction by single slit	
8	22	Diffraction by double slit, Diffraction gratings	
	23	Polarization and Production and analysis of polarized light	
	24	Optics of crystals, Nicole prism	
9	25	Brewster's and Malus law	
	26	Optical activity and polarimeter	
	27	Laser & its applications	
10	28	Theory of relativity: Frame of Reference, Postulates of special relativity, Galilean Transformation	
	29	Theory of relativity: Lorentz Transformations, Length Contraction and Time dilation	
	30	Velocity addition, Relativistic mass: Concept of relativistic mass and its expression	
11	31	Theory of relativity: Mass and Energy equivalence equation and concept of Massless particle and its expression. Related numerical problems	
	32	Photoelectric Effect, photocurrent and work function, kinetic energy, stopping potential	
	33	photoelectric equation, characteristics of photoelectric effect	
12	34	Compton effect: Definition, Compton wavelength shift, limitation	CT/ Assignment-4
	35	De Broglie Concept, Condition for wave and particle behavior, Bohr atomic model	
	36	Expression for Bohr radii and orbital energy for hydrogen atom	
13	37	Classification of Nucleus, nuclear binding energy	

	38	Radioactivity and its transformation, Radioactive Decay Law,	
	39	half- life, Mean life, nuclear reaction	
14	40	Concept of Fusion, Fission and nuclear chain reaction	
	41	General idea on nuclear reactor and nuclear power plant	
	42	Follow up of the course	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class Assignments/ Class Test/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2
Final Examination	60%	CO1, CO2, CO3	C1, C2
Total Marks	100%		

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

Physics

Fall Semester: Level 1 Term II

COURSE INFORMATION			
Course Code Course Title	: PHY 107 : Structure of Matter, Heat and Temperature, Kinetics and Kinematics	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
PHY 101			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This course is the basic physics in the field of Structure of Matter, Heat and Temperature, Kinetics and Kinematics. The course will be emphasised the basic concepts, theories and solve quantitative problems which can be applicable in a wide spectrum of engineering Disciplines.			
OBJECTIVE			
• To define the different parameter and concepts of Structure of Matter, Heat and Temperature, Kinetics and Kinematics. • To explain the basic theories of Structure of Matter, Heat and Temperature, Kinetics and Kinematics. • To solve numerical problems regarding Structure of Matter, Heat and Temperature, Kinetics and Kinematics.			
COURSE CONTENT			
Structure of matter: crystalline and non-crystalline solids, single crystal and poly-crystal solids, unit cell, crystal systems, co-ordinations number, crystal planes and directions, NaCl and CsCl structure, packing factor, Miller indices, relation between inter-planar spacing and Miller indices, Bragg's law, methods of determination of inter-planar spacing from diffraction patterns; defects in solids: point defects, line defects, bonds in solids, inter-atomic distances, calculation of cohesive and bonding energy; introduction to band theory: distinction between metal, semiconductor and insulator. **Heat and Temperature:** Heat energy and temperature; Thermal conductivity, specific heat, basic concept and equations of heat transfer, Workout Examples of Heat transfer through different mediums, rate of heat transfer; heat losses, conduction, convection and radiation. **Kinetics and Kinematics:** Introduction to Kinetics and Kinematics; Plane Motion (Linear, Curvilinear and Angular motion, Trajectory, Principles of Falling Objects, S.H.M.); Work, Kinetic Energy, Power, Impulse and Momentum.			

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	Be able to **Define** different basic parameters in the field of Structure of Matter, Heat and Temperature, Kinetics and Kinematics such as crystal structure, crystal defects, heat transfer, linear and angular momentum etc.	√											
2	Be capable to **Explain** different basic theories in the field of Structure of Matter, Heat and Temperature, Kinetics and Kinematics such as the Bragg's law, bonding energy, thermal conductivity, Trajectory, Principles of Falling Objects etc.	√											
3	Be skilled to **Solve** quantitative problems in the field of Structure of Matter, Heat and Temperature, Kinetics and Kinematics such as packing factor, Miller indices, rate of heat transfer, Work,	√											

	Kinetic Energy, Power, Impulse and Momentum etc.												

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Be able to **Define** different basic parameters in the field of Structure of Matter, Heat and Temperature, Kinetics and Kinematics such as crystal structure, crystal defects, heat transfer, linear and angular momentum etc.	1	C1	-	-	1	Quiz, Mid Term examination, Final Exam
CO2	Be capable to **Explain** different basic theories in the field of Structure of Matter, Heat and Temperature, Kinetics and Kinematics such as the Bragg's law, bonding energy, thermal conductivity, Trajectory, Principles of Falling Objects etc.	1	C1/ C2	-	-	1	Mid Term examination, Final Exam
CO3	Be skilled to **Solve** quantitative problems in the field of Structure of Matter, Heat and	1	C2	-	-	2	Class Assessment, Quiz, Mid Term

	Temperature, Kinetics and Kinematics such as packing factor, Miller indices, rate of heat transfer, Work, Kinetic Energy, Power, Impulse and Momentum etc.						examination, 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) Class assessment (2 hours/14 weeks)	 42 2
Guided Learning Tutorials/Assignment Preparation	 15
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for test and examination	 36 22
Assessment Pop quiz/ Class Test/Mid-Term Examination Final Examination	 02 03
Total	120

TEACHING METHODOLOGY

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

TEACHING SCHEDULE

Week	Lectures	Topics	Remarks
1	1	Introductory class: Brief discussion on total syllabus, basic requirements of the course, assessment of the course	CT/ Assignment/ Final Exam
	2	Classification of solids, Types of crystalline solids. Important definitions; crystal, lattice, basis,	

		crystal structure, plane lattice, space lattice, Bravis and non-bravise lattice.	
	3	Lattice parameters: unit cell, primitive and non-primitive cells and their distinctions, lattice symbols, Crystal structure of NaCl and CsCl	
2	4	Unit face, axial units: linear and numerical parameters and, Miller indices	
	5	Packing factor and coordination number for different cubic structures.	
	6	Relation between lattice constant and density of solids and related numerical problems.	
3	7	Inter-planer spacing and its expression, related mathematical problems,	
	8	X-ray diffraction and Bragg's law and related numerical problems.	
	9	Atomic bonds in solids	
4	10	Energy bands in solids	CT/ Assignment/ Mid Term Exam
	11	Types of semiconductors	
	12	Inter-atomic distance, force of equilibrium.	
5	13	Total potential/cohesive energy at the equilibrium separation of an Ionic crystal.	
	14	Mathematical Problems	
	15	Heat energy and temperature	
6	16	Different thermometers	Mid Term/ Assignment/ Mid Term/ Final Exam
	17	Mathematical Problems	
	18	Mathematical Problems	
7	19	Thermal conductivity	
	20	specific heat	
	21	Mathematical Problems	
8	22	basic concept and equations of heat transfer	
	23	Workout of Heat transfer through different mediums	
	24	Mathematical Problems	
9	25	rate of heat transfer; heat losses, conduction, convection and radiation	
	26	rate of heat transfer; heat losses, conduction, convection and radiation	
	27	rate of heat transfer; heat losses, conduction, convection and radiation	

10	28	Mathematical Problems	
	29	Introduction to Kinetics and Kinematics	
	30	Plane Motion (Linear, Curvilinear and Angular motion, Trajectory, Principles of Falling Objects)	
11	31	Mathematical Problems	
	32	Plane Motion (Linear, Curvilinear and Angular motion, Trajectory, Principles of Falling Objects)	
	33	Mathematical Problems	
12	34	Plane Motion (Linear, Curvilinear and Angular motion, Trajectory, Principles of Falling Objects)	CT/ Assignment/ Final Exam
	35	Mathematical Problems	
	36	Work	
13	37	Work	
	38	Mathematical Problems	
	39	Kinetic Energy, Power	
14	40	Impulse and Momentum	
	41	Mathematical Problems	
	42	Mathematical Problems	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class Assignments/ Class Test/ Mid Term/ Active Class Participation)	60%	CO1, CO2, CO3	C1, C2
Final Examination	50%	CO1, CO2, CO3	C1, C2
Total Marks	100%		

REFERENCE BOOKS

1. Fundamentals of Physics: Halliday, Resnick and Walker
2. Physics for Scientists and Engineers: Serway and Jewett
3. Analytical Mechanics: V.M. Faires and S. D. Chambers
4. An Introduction to Mechanics: Daniel Kleppner and Robert Kolenkow
5. Introduction to Solid State Physics: Charles Kittle
6. Solid State Physics: S. O. Pillai
7. Solid State Physics: Ali Omar

Chemistry

Spring Semester: Level 1 Term I

COURSE INFORMATION			
Course Code Course Title	: CHEM 101 : Fundamentals of Chemistry	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This course is a basic chemistry covering the field of inorganic, organic and physical chemistry. The course emphasizes on the basic concepts, theories and solve quantitative problems which can be applied in a wide spectrum of engineering disciplines.			
OBJECTIVE			
• To define the different parameter and concepts of inorganic chemistry and physical chemistry. • To explain basic reaction mechanism of selective organic reactions. • To solve numerical problems of inorganic, organic and physical chemistry.			
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 of chemical bonding, Lewis theory, VBT, MOT, Hybridization and shapes of molecules **Selective organic reactions:** Oxidation-reduction, Substitution, Addition, Polymerization, Alkylation reactions **Phase Rule:** Basic terms and phase rule derivation, Phase diagram of water and carbon dioxide **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 **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			

Chemical Equilibrium: Equilibrium law/constant, Kp and Kc, Homogeneous and heterogeneous equilibrium, Van’t Hoff’s reaction isotherm, Le Chatelier's principle

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

Electrical properties of solution: Conductors & nonconductors, difference between electrolytic and metallic conduction, electrolytic conductance, Factors influencing the conductivity of electrolytes, Kohlrausch Law & conductometric titrations.

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	**Define** different basic parameters in the field of inorganic, organic and physical chemistry i.e., atomic structure, periodic table, chemical bonding, acids and bases, chemical equilibrium, thermo-chemistry and different types of solutions, phase rule etc.	√											
2	**Explain** different basic theories in the field of selective organic reactions such as Oxidation-reduction, Substitution, Addition, Polymerization, Alkylation reactions etc.	√											
3	**Solve** quantitative problems in the field of inorganic, organic and physical chemistry i.e., solutions, thermochemistry, chemical kinetics, electrical properties of solution etc.	√											

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Define** different basic parameters in the field of inorganic, organic and physical chemistry i.e., atomic structure, periodic table, chemical bonding, acids and bases, chemical equilibrium, thermo-chemistry and different types of solutions, phase rule etc.	1	C1	-	-	1	Quiz, Mid Term Examination, Final Exam
CO2	**Explain** different basic theories in the field of selective organic reactions such as Oxidation-reduction, Substitution, Addition, Polymerization, Alkylation reactions etc.	1	C2	-	-	1	Quiz, Mid Term Examination, Final Exam
CO3	**Solve** quantitative problems in the field of inorganic, organic and physical chemistry i.e., solutions, thermochemistry, chemical kinetics, electrical properties of solution etc.	1	C3	-	-	2	Class Assignment, Quiz, Mid Term Examination, 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 Tutorials/Assignment Preparation	-
Independent Learning Individual learning Revision	84 21
Assessment Class assessment Pop quiz/ Class Test/Mid-Term Examination Final Examination	02 01 03
Total	153

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

TEACHING SCHEDULE

Week	Topic	Remarks
1	Concepts of atomic structure, Different atom models	Class Test, Final Exam
	Concepts of atomic structure, Different atom models	
	Quantum numbers, Electronic configurations	
2	Hydrogen spectral lines, Heisenberg's uncertainty principle	
	Classification of elements according to electronic configurations	
	Periodic classification of elements	
3	Periodic properties of elements, Properties and uses of noble gases	
	Periodic properties of elements, Properties and uses of noble gases	
	Chemical bonding (types, properties, Lewis theory, VBT)	
4	Molecular orbital theory (MOT)	Class Test, Final Exam
	Molecular orbital theory (MOT)	
	Hybridization and shapes of molecules	
5	Hybridization and shapes of molecules	

	Hybridization and shapes of molecules	
	Oxidation-reduction, Substitution	
6	Addition, Polymerization, Alkylation	
	Phase Rule: Basic terms and phase rule derivation	
	Phase diagram of water and carbon dioxide	
7	Different concepts of acids-bases	Mid Term, Final Exam
	Buffer solution, Mechanism of buffer solution	
	Henderson-Hasselbalch equation	
8	Solutions and their classification,	
	Units of expressing concentration	
	Effect of temperature and pressure on solubility, Validity and limitations of Henry's law	
9	Colligative properties and dilute solutions	
	Raoult's law, deviation from Raoult's law, Elevation of boiling point	
	Freezing point depression, Van't Hoff's law of osmotic pressure	
10	Laws of thermochemistry, Enthalpy	
	Hess's law, Heat of formation, Kirchoff's equations	
	Heat of neutralization, Heat of reaction	
11	Reversible reactions, Characteristics of chemical equilibrium, Law of mass action, Equilibrium constant, Units of equilibrium constant	Class Test, Final Exam
	Relation between K_p & K_C,Van't Hoff's reaction isotherm	
	Free energy and its significance Heterogeneous equilibrium	
12	Le Chatelier's principle	
	Reaction rate, Units of rate, Rate laws, Order of reaction, Molecularity of a reaction, Pseudo-order reaction	
	Reaction rate, Units of rate, Rate laws, Order of reaction, Molecularity of a reaction, Pseudo-order reaction	
13	First order reactions, 2nd order reactions, units of rate constant, half-life of a reaction	
	Collision theory of reaction rates, Effect of increase of temperature on reaction rate, Determination and factors affecting the rate of a reaction	
	Limitations of the collision theory, Transition state theory, Activation energy and catalysis	
14	Conductors & nonconductors, Difference between electrolytic and metallic conduction, Electrolytic conductance	

	Factors influencing the conductivity of electrolytes, Kohlrausch Law,	
	Conductometric titrations.	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class Assignments/ Class Test/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C3
Final Examination	60%	CO1, CO2, CO3	C1, C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. S. Z. Haider, Modern Inorganic Chemistry, 1st Edition, Friends International, 2005
2. J. D. Lee, Concise Inorganic Chemistry, 5th Edition, Wiley India Pvt. Limited, 2008
3. Arun Bahl And B. S. Bahl, A Textbook of Organic Chemistry, 16th Edition, Chand, 1997
4. Morrison and Boyd, Organic Chemistry, 6th Edition, Prentice Hall, 1998
5. Haque and Nawab, Principles of Physical Chemistry, 1st Edition, Nawab Publications, 2005
6. Bahl and Tuli, Essentials of Physical Chemistry, Revised Edition, S. Chand Limited, 2000
7. Atkins, Physical Chemistry, Revised Edition, OUP Oxford, 2010

Chemistry

Fall Semester: Level 1 Term II

COURSE INFORMATION			
Course Code Course Title	: CHEM 105 : Environmental Chemistry	Lecture contact hours Credit hours	: 3.00 : 3.00
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 helps to understand the elements of pollution and their sources. Students will be acquainted with a solid knowledge of analytical chemistry to environmental processes which will be used in later semester and also in professional life.			
OBJECTIVE			
• To develop a indepth understanding of chemical processes underlying the operation of the natural environment. • To recognize the mobility of various contaminants in air, soils and waters. • To explain how human impacts on chemical processes can lead to degradation of the natural environment; • To understand the significance of contaminants.			
COURSE CONTENT			
Atmospheric chemistry: Atmospheric cycles; air pollution and pollutants - criteria and critical pollutants; ozone hole and stratospheric ozone depletion; chemical and photochemical reactions in atmosphere; hydrocarbons and photochemical smog. **Aquatic chemistry:** Water properties; solubility of gases and solids; colloidal suspension; Complexation reactions, solution approaches for aqueous equilibrium; Aqueous carbonate system; general concept on – alkalinity, pH, capacity diagram, 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.			

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	**Explain** the chemical and biochemical principles of fundamental environmental processes in air, water, and soil.	√											
2	**Identify** the elements of pollution, their sources, and how contaminants propagate in environment.		√										
3	**Understand** basic chemical concepts to analyze chemical processes involved in different environmental compartments.		√										

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Explain** the chemical and biochemical principles of fundamental environmental processes in air, water, and soil.	1	C2	1	-	1	Class Test, Mid-term, Final Exam
CO2	**Identify** the elements of pollution, their sources, and how contaminants propagate in environment.	2	C2	1	-	1	Class Test, Mid-term, Final Exam

CO3	**Understand** basic chemical concepts to analyze chemical processes involved in different environmental compartments.	1	C2	1	1	2	Class Test, Mid-term, Final Exam

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

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	10
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	42 21
Assessment Continuous Assessment Final examination	2 3
Total	120

TEACHING METHODOLOGY

Lecture, Tutorials, Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Assessments
1	Introduction to environmental chemistry and chemistry concepts	Class Test, Final exam
	Pollution perspective	
	Major pollutants	
2	Fate and behavior of chemicals in environment	
	Ecological concepts in the environment	
	Types, sources, and degradation of pollutants	Final exam

3	Atmospheric cycles; air pollution, and pollutants - criteria and critical pollutants;	
	Effect of air pollution on human	
	Effect of air pollution on vegetation, and materials	
4	ozone hole and stratospheric ozone depletion,	Mid Term, Final exam
	Climate change, Greenhouse gas emission.	
	Air chemistry, chemical and photochemical reactions in atmosphere	
5	Chemical and photochemical reactions in atmosphere	
	hydrocarbons and photochemical smog.	
	Case studies	
6	Introduction to aqueous chemistry	Class Test, Final exam
	Solubility of gases and solids	
	Colloidal suspension	
7	complexation reactions	
	Solution approaches for aqueous equilibrium	
	Aqueous carbonate system, General concept on – alkalinity, pH, capacity diagram, electron activity	Mid Term, Final exam
8	General concept on – alkalinity, pH, capacity diagram, electron activity	
	Redox reactions, equilibria	
	Complexation reaction	
9	Organic and inorganic pollutants, Aliphatic compounds, Heterocyclic compounds	
	Behavior of organics in water	Class Test, Final exam
	Adsorption isotherms	
10	Heavy metal contamination	
	Chemical fate of pollutants in water	Final exam`
	Chemical fate of pollutants in water	
11	Case studies	
	Introduction to soil chemistry	
	Soil Composition;	
12	Acid-base and ion exchange equilibria in soil	

	Acid-base and ion exchange equilibria in soil	
	Pollution mobilization from farming.	
13	Chemistry of pesticides and insecticides	
	Insecticides	
	Anti-biotics in environments	
14	Food preservatives	
	Case studies	
	Review class	-

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C2, C3
Final Exam	60%	CO 1	C2
		CO 2	C2
		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS

1. General Chemistry – by Ebbing, D.D. AITBS Publishers & Distributors, Delhi.
2. Chemistry and Chemical Reactivity, J.C. Kotz and Paul Treichel, (Sanders)

Physics Sessional

Fall Semester: Level 1 Term II

COURSE INFORMATION			
Course Code Course Title	: PHY 102 : Physics Sessional	Lecture contact hours Credit hours	: 3.00 : 1.50

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
To learn the basic concepts of Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics related parameter in practical.

OBJECTIVE
• To develop basic physics knowledge practically • To practice use of basic scientific instrument

COURSE CONTENT
Quantitative measurement of different parameters in the field of Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics such as: Specific resistance of materials, high resistance, 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.

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	**Define** the different parameters regarding Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc.	√											

2	**Describe** the different phenomena regarding Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc.	√											
3	**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.									√			

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Define** the different parameters regarding Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc.	1	C1	-	-	1	Quiz
CO2	**Describe** the different phenomena regarding Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc.	1	C1	-	-	1	Test, Final Exam

CO3	**Construct e**xperiments by an individual or by a group to determine different phenomena regarding Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc..	9	C3	-	-	2	Test, Final Exam

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning	
Lecture	30
Practical / Experiment	20
Student-Centered Learning	-
Guided Learning	
Lab Report Preparation	15
Independent Learning	
Preparation of Lab-test	20
Preparation of Quiz	20
Preparation of viva	09
Assessment	
Continuous Assessment	02
Quiz	01
Final lab exam	03
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Experiments.

TEACHING SCHEDULE

Week	Lectures	Topics	Assessments
1	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	CT/ Assignment-1
2	4	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	
3	7	Determination of a high resistance by the method of deflection/ Determination of specific heat of a liquid by the method of cooling	
4	10	Determination of ECE of copper by using copper voltameter / Determination of the Young's modulus of bar by bending method	CT/ Assignment-2
5	13	Determination of the wavelength of light by using diffraction grating	
6	16	Determination of the focal length of a plano-convex lens by Newton's ring method	Mid Term/ Assignment-3
7	19	Determination of the specific rotation of sugar by polarimeter	
8	22	Determination of the conductivity of a bad conductor by Lee's method / Verification of the law of conservation of linear momentum	
9	25	Determination of the acceleration due to gravity by means of compound pendulum	
10	28	Determination of the spring constant and the rigidity modulus of a spiral spring	
11	31	Determination of the Planck's constant using photoelectric effect	
12	34	Viva & experimental exam	CT/ Assignment-4
13	37	Viva & experimental exam	
14	40	Quiz exam	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment	40%	CO1, CO4	C1, C2

(Class performance, Report Writing)			
Final Examination (Lab Test, Viva, Quiz)	60%	CO1, CO2, CO3	C1, C3
Total Marks	100%		

REFERENCE BOOKS

1. G. L. Squires, Practical Physics, 4th Edition, Cambridge University Press, 2001.
2. Dr. Giasuddin and Md. Sahabuddin, Practical Physics.
3. C. L Arora, B.Sc. Practical Physics, 13 th Edition, S. Chand, 1969.
4. S.L. Gupta and V. Kumar, Practical Physics.

Chemistry Sessional

Spring Semester: Level 1 Term I

COURSE INFORMATION			
Course Code Course Title	: CHEM 102 : Chemistry Sessional	Lecture contact hours Credit hours	: 3.00 : 1.50

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This course is a laboratory course for the basic chemistry in the field of inorganic and physical chemistry. The course will be emphasized by fundamental experiments on different fields of chemistry which can be applicable in a wide spectrum of engineering disciplines. This laboratory course will enable students to understand basic chemistry practically as well as do work with team or individual.

OBJECTIVE
• To develop basic chemistry knowledge practically • To practice the use of basic scientific instrument.

COURSE CONTENT
Quantitative chemical analysis in the field of inorganic and physical chemistry such as: Acid-base titration, Redox titration, Iodometric and Iodometric titration, Complexometric titration. Na2-EDTA) Solution by using Eriochrome black T indicator.

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	**Define** the different parameters regarding inorganic and physical chemistry.	√											
2	**Describe** the different phenomena regarding acid-base, iodo-iodimetric, complexometric and redox titration etc.	√											

3	**Construct** Experiments by an individual or by a group to determine different phenomena regarding acid-base, iodo-iodimetric, complexometric and redox titration etc.								√				

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Define** the different parameters regarding inorganic and physical chemistry.	1	C1	-	-	1	Quiz
CO2	**Describe** the different phenomena regarding acid-base, iodo-iodimetric, complexometric and redox titration etc.	1	C1	-	-	1	Test, Final Exam
CO3	**Construct** Experiments by an individual or by a group to determine different phenomena regarding acid-base, iodo-iodimetric, complexometric and redox titration etc.	9	C3	-	-	2	Test, Final Exam

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

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture	10

Practical / Experiment Student-Centered Learning	18 -
Guided Learning Lab Report Preparation	 18
Independent Learning Preparation of Lab-test Preparation of Quiz Preparation of viva	25 9 9
Assessment Continuous Assessment Quiz Final lab exam	02 01 03
Total	95

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Experiments

TEACHING SCHEDULE

Week	Topics	Remarks
1	Orientation and Introductory lecture	Quiz, Test, Final Examination, Report
2	Standardization of Sodium Hydroxide (NaOH) Solution with Standard Oxalic Acid dihydrate ($C_2H_2O_4.2H_2O$) Solution	
3	Standardization of Hydrochloric Acid (HCl) Solution with Standard Sodium Hydroxide (NaOH) Solution.	
4	Standardization of Hydrochloric Acid (HCl) Solution with Standard Sodium Carbonate (Na_2CO_3) Solution	
5	Determination of Calcium (Ca) Content in a Calcium Chloride dihydrate ($CaCl_2.2H_2O$) Solution with Standard Di-Sodium Ethylenediaminetetraacetic Acid (Na_2EDTA) Solution.	
6	Mid Term	
7	Standardization of Sodium Thiosulphate Pentahydrate ($Na_2S_2O_3.5H_2O$) Solution with Standard Potassium Dichromate ($K_2Cr_2O_7$) Solution.	
8	Estimation of Copper (Cu) Content in a Copper Sulphate Pentahydrate ($CuSO_4.5H_2O$) (Blue Vitriol) Solutions by Iodometric Method with Standard Sodium Thiosulphate Pentahydrate ($Na_2S_2O_3.5H_2O$) Solution.	
9	Standardization of Potassium Permanganate ($KMnO_4$) Solution with Standard Oxalic Acid dihydrate ($C_2H_2O_4.2H_2O$) Solution.	

10	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.	
11	Revision class and final lecture	-
12	Exam	-
13	Viva	-
14	Reserved for exam (if required)	-

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment Class performance Report Writing	 10% 30%	CO1, CO4	C1, C2
Final Examination Lab Test Viva Quiz	 30% 10% 20%	CO1, CO2, CO3	C1, C3
Total Marks	100%		

REFERENCE BOOKS

1. G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, 5th Edition, Longman Scientific & Technical, 1989
2. G. D. Christian., Analytical Chemistry, 6th Edition, Wiley India Pvt. Limited, 2007

5.2 Mathematics

Spring Semester: Level 1 Term I

COURSE INFORMATION			
Course Code Course Title	: MATH 101 : Differential and Integral Calculus	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
The purpose of this course is to impact basic knowledge of Differential Calculus and how to use it in engineering problem.			
OBJECTIVE			
• 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. • Apply the concepts or techniques of differentiation and integration to solve the problems related to engineering study. • Calculate the length, area, volume, center of gravity and average value related to engineering study.			
COURSE CONTENT			
Differential Calculus: Introduction, Differential Calculus for Engineering, Function and Limit, Continuity and Differentiability, Successive Differentiation, Leibnitz'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.			

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	**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.	√											
2	**Apply** the concepts or techniques of differentiation and integration to solve the problems related to engineering study.	√											
3	**Calculate** the length, area, volume, center of gravity and average value related to engineering study.	√											

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	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	1	C1, C2	1	-	3	Class Test, Assignment, Final Exam

	techniques of evaluating indefinite and definite integrals.						
CO2	**Apply** the concepts or techniques of differentiation and integration to solve the problems related to engineering study.	1	C3	1	-	3	Class Test, Mid-term, Final Exam
CO3	**Calculate** the length, area, volume, center of gravity and average value related to engineering study.	1	C3	1	-	3	Assignment, Mid-term, Final Exam
WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile							

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	-
Independent Learning Individual learning Preparation for tests and examination	 84 21
Assessment Continuous Assessment Mid Term Examination Final Examination	 2 1 3
Total	153

TEACHING METHODOLOGY
Lecture, Tutorials, Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Remarks
1	Introduction to Differential Calculus for Engineering study, Limit of a function and its properties.	Class Test, Final Exam
	Basic limit theorems with proofs, Limit of infinity and infinite limit, Sandwich (Squeezing) theorem with problems.	
	Concept of Differentiation, definition, classification of discontinuity and solving problems	
2	Basic concept of Differentiability, definition, derivative of a function, differentiable function.	
	Differentiability – one sided derivative (R.H.D and L.H.D), solving problems	
	Successive differentiation – Concept and problem solving	
3	Leibnitz's theorem and its applications	
	Determination of $(y_n)_0$	
	Mean Value theorem, Taylor theorem	
4	Expansion of finite and infinite forms, Lagrange's and Cauchy's form of remainder.	Class Test, Final Exam
	Indeterminate forms – concept and problem solving,	
	L'Hospital's rules with application	
5	Partial differentiation - partial derivatives of a function of two variables and problems	
	Partial differentiation - partial derivatives of a homogeneous function of two variables, Euler's theorem for two variables and problems	
	Partial differentiation - partial derivatives of a homogeneous function of several variables, Euler's theorem for several (three and m) variables and problem solving	
6	Addition, Polymerization, Alkylation	
	Phase Rule: Basic terms and phase rule derivation	
	Phase Diagram of water and carbon dioxide	
7	maxima and minima of functions of single variables – concept, Increasing and decreasing function, Concave up and down with problems	
	Curvature	
	Asymptotes	
8	Introduction to integral calculus	Mid Term Examination, Final Exam
	Standard integrals – concept of definite and indefinite integrals, applications.	
	Indefinite integrals – Method of substitution, Techniques of integration	
9	Indefinite integrals – Integration by parts, Special types of integration, integration by partial fraction,	
	Integration by the method of successive reduction	

	Definite integrals – definite integrals with properties and problems	
10	Definite integrals – Reduction formula, Walli's formula	
	Definite integrals – definite integral as the limit of the sum	
	Beta function – concept and problem solving	
11	Gamma function - concept and problem solving	Class Test, Mid Term Examination, Final Exam
	Relation between beta and gamma function, Legendre duplication formula, problems and applications	
	Multiple integrals – double integrals	
12	Multiple integrals – triple integrals	
	Multiple integrals – successive integration for two and three variables	
	Area in Cartesian	
13	Area in polar	
	Volume of solid revolution	
	Area under a plain curve in Cartesian and polar coordinates	
14	Area of a region enclosed by two curves in Cartesian and polar coordinates	
	Arc lengths of curves in Cartesian coordinates	
	Arc lengths of curves in polar coordinates	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C3
Final Exam	60%	CO 1	C1, C2
		CO 2	C2
		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS

1. Howard Anton, Irl C. Bivens, Stephen Davis, Calculus, 10th Edition, Wiley, 2012.
2. Morris Kline, Calculus: An Intuitive and Physical Approach, , 2nd Edition, Courier Corporation, 2013.

Mathematics
Fall Semester: Level 1 Term II

COURSE INFORMATION			
Course Code Course Title	: MATH 103 : Differential Equations and Matrix	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
The purpose of this course is to impact basic knowledge to identify and solve differential equations and concept of matrix.			
OBJECTIVE			
• To impart basic knowledge on ordinary and partial differential equations. • Developing understanding some of the important aspects of ordinary and partial differential equations. • To provide knowledge on using concept of Differential equations and matrix in engineering problems and solve other applied problems. • To be expert in imparting in depth knowledge on inverse matrix.			
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, Non-linear 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.			

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	**Define** various types of differential equations and **identify** the classifications of ordinary and partial differential equations.	√											
2	**Apply** the knowledge to identify and **solve** ordinary and partial differential equations.	√											
3	**Apply** the knowledge to identify and **solve** ordinary and partial differential equations.	√											

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Define** various types of differential equations and **identify** the classifications of ordinary and partial differential equations.	1	C1, C2	1	-	3	Class Test, Assignment, Final Exam
CO2	**Apply** the knowledge to identify and **solve** ordinary and partial differential equations.	1	C3	1	-	3	Class Test, Mid-term, Final Exam
CO3	**Calculate** the length, area, volume, center of gravity and average value related to engineering study.	1	C3	1	-	3	Assignment, Mid-term, Final Exam

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

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	-
Independent Learning Individual learning Preparation for tests and examination	 84 21
Assessment Continuous Assessment Mid Term Examination Final Examination	 2 1 3
Total	153

TEACHING METHODOLOGY

Lecture, Tutorials, Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Assessments
1	Introduction & Formulation of DE in Eng, Degree and order of ODE	Class Test, Final Exam
	Introduction & Formulation of DE in Eng, Degree and order of ODE	
	Introduction & Formulation of DE in Eng, Degree and order of ODE	
2	Solution of first order but higher degree DE by various methods	
	Solution of first order but higher degree DE by various methods	
	Solution of first order but higher degree DE by various methods	
3	Solution of general DEs of second and higher order, Solution of Euler's homogeneous linear DEs	
	Solution of general DEs of second and higher order, Solution of Euler's homogeneous linear DEs	
	Solution of general DEs of second and higher order, Solution of Euler's homogeneous linear DEs	
4	Solution of DEs by methods based on factorization, Frobenious methods, Bessel's functions, Legendre's polynomial	Class Test, Final Exam

	Solution of DEs by methods based on factorization, Frobenious methods, Bessel's functions, Legendre's polynomial	
	Solution of DEs by methods based on factorization, Frobenious methods, Bessel's functions, Legendre's polynomial	
5	Linear first order PDE, Non-linear first order PDE	
	Standard form DEs of higher order and wave equation	
	Standard form DEs of higher order and wave equation	
6	Particular solutions with boundary and initial condition, Non-linear PDE of order one: Charpit's method	
	Particular solutions with boundary and initial condition, Non-linear PDE of order one: Charpit's method	
	Particular solutions with boundary and initial condition, Non-linear PDE of order one: Charpit's method	
7	Linear PDE with constant coefficients, Applications of DE	
	Linear PDE with constant coefficients, Applications of DE	
	Linear PDE with constant coefficients, Applications of DE	
8	Wave equations	Mid Term Examination, Final Exam
	Particular solutions with boundary and initial conditions	
	Particular solutions with boundary and initial conditions	
9	Second order PDE and classifications to canonical (standard)-parabolic, elliptic, hyperbolic solution by separation of variables,	
	Second order PDE and classifications to canonical (standard)-parabolic, elliptic, hyperbolic solution by separation of variables,	
	Second order PDE and classifications to canonical (standard)-parabolic, elliptic, hyperbolic solution by separation of variables,	
10	Application of OD and PDE in Eng study	
	Definition of Matrix, different types of matrices, Algebra of Matrices,	
	Transpose and adjoint of a matrix and inverse matrix	
11	Solution of linear equation or System of Linear Equation	Class Test, Final Exam
	Solution of linear equation or System of Linear Equation	
	Solution of linear equation or System of Linear Equation	
12	Solution of linear equation using Inverse Matrix	
	Rank, Nullity and elementary transformation	
	Rank, Nullity and elementary transformation	
13	Dependent and independent of vectors	
	Dependent and independent of vectors with examples	
	Matrix polynomials determination characteristic roots and vectors	
14	Characteristic subspace of matrix and Eigen values and Eigen Vectors,	

	Characteristic subspace of matrix and Eigen values and Eigen Vectors,	
	Cayley Hamilton theorem and its application. Finding inverse matrix using this theorem.	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C3
Final Exam	60%	CO 1	C1, C2
		CO 2	C2
		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS

1. Howard Anton, Chris Rorres, Anton Kaul, Elementary Linear Algebra ,12th Edition, John Wiley & Sons, 2019
2. Dr. M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand Publishing, 2013

Mathematics

Spring Semester: Level 2 Term I

COURSE INFORMATION			
Course Code Course Title	: MATH 201 : Vector Analysis, Laplace Transform and Coordinate Geometry	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
The 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			
• To impart basic knowledge on the vector analysis, Laplace transform and geometry. • To familiarize the students with straight lines, pair of straight lines, circles, conics in 2D and 3D co-ordinate systems. • To find the length, volume and area of objects related to engineering study by using vector, application of Laplace transforms to ordinary differential equations and also solve the problems of the pair of straight lines, circles, system of circles, parabola, ellipse etc.			
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.

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	**Know** the physical explanation of different vector notation and **Define** Laplace transform, inverse Laplace transform, different types of matrices, and their properties.	√											
2	**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	**Calculate** length, volume and area of objects related to engineering study by using vector, **Apply** Laplace transform to ODE and PDEs and the knowledge of geometry in engineering study. **Solve** the problems of the pair of straight lines, circles, system of circles, parabola, ellipse etc.	√											

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Know** the physical explanation of different vector notation and **Define** Laplace transform, inverse Laplace transform, different types of matrices, and their properties.	1	C1, C2	1	-	3	Assignment, Class Test, Final Exam
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.	1	C2	1	-	3	Class Test, Mid-Term Exam, Final Exam
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.	1	C3	1	-	3	Assignment, Mid-Term Exam, Final Exam
WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile							

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	-
Independent Learning Individual learning Preparation for tests and examination	 84 21
Assessment Continuous Assessment Mid Term Examination Final Examination	 2 1 3
Total	153
TEACHING METHODOLOGY	
Lecture, Tutorials, Discussion, Problem Based Learning (PBL)	
TEACHING SCHEDULE	

Week	Topics	Assessments
1	Definition of Vector and scalers & vector algebra, Scaler and vector products of two vectors and their geometrical interpretation	Class Test, Final Exam
	Definition of Vector and scalers & vector algebra, Scaler and vector products of two vectors and their geometrical interpretation	
	Definition of Vector and scalers & vector algebra, Scaler and vector products of two vectors and their geometrical interpretation	
2	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	
3	Definition of line, surface and volume integral, Integration of Vectors, Green's theorem and application	
	Definition of line, surface and volume integral, Integration of Vectors, Green's theorem and application	
	Green’s theorem and its application	
4	Gauss theorem and application in Engineering	

	Stoke's theorem and its application.	Class Test, Final Exam
	Introduction to geometry for Engineering and Rectangular co-ordinates, Transformation of co-ordinates	
5	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	
	Changes of axes, pair of straight lines, general equation of second degree and reduction to its standard forms and properties	
	Changes of axes, pair of straight lines, general equation of second degree and reduction to its standard forms and properties	
6	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	
	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	
	Circles (tangents, normal, chord of contact, pole and polar), Equation of conics, homogeneous equations of second degree, angle between straight lines, pair of lines joining the origin to the point of intersection of two given curves	
7	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	
	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points	
8	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points	Mid Term Examination, Final Examination
	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points	
	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points	

9	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	
	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	
	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	
10	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	
	Definition of LT and Application of LT for Engineering, LT of some elementary functions and properties of LT	
	Definition of LT and Application of LT for Engineering, LT of some elementary functions and properties of LT	
11	Sufficient condition for existence of LT	Class Test, Final Exam
	LT of derivatives and its application	
	LT of Integration with application, LT of sine and cosine integral	
12	Unit step function and its application	
	Periodic function with examples, LT of some special function.	
	Definition of inverse Laplace Transform and its properties	
13	Partial fraction and its application in inverse Laplace Transform	
	Heaviside formula and its application	

	Convoulution theorem, Evaluation of improper integral, Application of LT	
14	Solve ODE s by Laplace transform	
	Solve PDE s by Laplace transform	
	Application of LT in Eng. study	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C3
Final Exam	60%	CO 1	C1, C2
		CO 2	C2
		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS

1. Murray Spiegel, Seymour Lipschutz, Dennis Spellman, Vector Analysis, USA: McGraw-Hill Education, 2009.
2. Spiegel, Murray R., and José D. Arias Páez. "Schaum's outline of laplace transformsTransformadas de laplace" Schaum, 1998.
3. Kandasamy, P., K. Thilagavathy, and K. Gunavathy. Engineering Mathematics. India:S. Chand, 1986.

Mathematics

Fall Semester: Level 2 Term II

COURSE INFORMATION			
Course Code Course Title	: MATH 203 : Applied Mathematics for Engineers	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
MATH 101, MATH 103, MATH 201			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
In this course students will be introduced to various methods to solve various civil engineering problems dealing with probability and statistics. Students will also be able to apply different methods to solve differential equations.			
OBJECTIVE			
• To understand the basic concepts of probability distributions, Bayesian inference and relevant statistical methods. These concepts comprise foundational material utilized heavily in later year courses, particularly in water, structural, and geotechnical engineering. • To formulate civil engineering problems dealing with probability and statistics into mathematical frameworks and solve the resulting models. • To help the students to solve various differential equations using several methods like power series solution, method of Frobenius etc. Besides that, students will also be able to develop Fourier series for different kind of elements related to civil engineering structures.			
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. Application of statistical methods to engineering problems: Random variables; discrete and continuous probability distributions; functions of random variables and derived distributions; expectation and moments of random variables; point estimation of distribution parameters: methods of moments and maximum likelihood, Bayesian analysis; confidence intervals; hypothesis tests; nonparametric statistical tests; simple and multiple linear regression and model selection; uncertainty and reliability analysis; project level decision making and quality control.			

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	**Apply** differential equation and Fourier analysis to solve civil engineering problems	√											
2	**Apply** probability distribution theory and Bayesian inference to civil engineering problems focusing probability and statistical analysis		√										
3	**Develop** simple probabilistic models to evaluate uncertainty in civil engineering systems.	√											

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Apply** differential equation and Fourier analysis to solve civil engineering problems	1	C3	1,3	-	2,6	Class Test/Class Assignment/Final exam
CO2	**Apply** probability distribution theory and Bayesian inference to civil engineering problems focusing	2	C3	1,3	-	2,4	Class Test/Class Assignment/Final exam

	probability and statistical analysis						
CO3	**Develop** simple probabilistic models to evaluate uncertainty in civil engineering systems.	1	C4	2,3	-	2,4,6	Class Test/Class Assignment/Final exam

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (3 hours/week x 14 weeks)	42
Guided Learning Assignment Preparation (3.0 hours/week x 04 weeks)	12
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for quiz and final exam	48 7
Assessment Continuous assessment (Assignment/ Class Test) Final Exam	08 03
Total	120

TEACHING METHODOLOGY

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

TEACHING SCHEDULE

Week	**Topics**	**Assessments**
1	Background of statistical applications in Civil engineering.	Final Exam
	Introduction sample space, Venn diagram and probability model.	
2	Conditional probability, Joint Probability.	

	Baye's theorem, Bayesian statistics	Class Test/Class Assignment/ Final Exam
	Probability distribution functions and probability mass function.	Mid Term/ Class Assignment/ Final Exam
3	Joint probability mass function, cumulative distribution function, joint probability density function	
	Continuous random variable functions, Indicator random variables, Variance, Co-variance of two random variables	
	Bernoulli Distribution, Binomial distribution	
4	Poisson distribution	
	Moment generating function	
	Uniform distribution	
5	Normal Distribution	
	Standard Normal Distribution	
	Exponential Distribution	
6	Central Limit Theorem, Sample mean and sample variance	
	Quality criteria for estimates	
	Point estimation, method of likelihood Method of moments, interval estimation	Class Test/Final Exam
7	Hypothesis testing	
	Confidence interval	
	Linear Models, linear regression analysis	
8	Review of differential equation, power series solution	Mid Term/ Class Assignment/ Final Exam
9	Method of Frobenius	Final Exam
10	Legendre Polynomial	
11	Gamma Function	
12	Bessel's Function	Class Test / Final Exam

13	Fourier Series, Fourier Integral	Class Test/ Final Exam
14	Fourier Transform	Class Assignment/ Final Exam

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. Introduction to Probability and Statistics for Engineers and Scientists‖ – By Sheldon M. Ross.
2. Advanced Engineering Mathematics -Michael D. Greenberg 2nd Edition.

5.3 General Education Courses

Bangladesh Studies

Spring Semester: Level 1 Term I

<table>
<tr><th colspan="4">COURSE INFORMATION</th></tr>
<tr><td>Course Code
Course Title</td><td>: GEBS 101
: Bangladesh Studies</td><td>Lecture contact hours
Credit hours</td><td>: 2.00
: 2.00</td></tr>
<tr><th colspan="4">PRE-REQUISITE</th></tr>
<tr><td colspan="4">None</td></tr>
<tr><th colspan="4">CURRICULUM STRUCTURE</th></tr>
<tr><td colspan="4">Outcome Based Education (OBE)</td></tr>
<tr><th colspan="4">SYNOPSIS/RATIONALE</th></tr>
<tr><td colspan="4">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.</td></tr>
<tr><th colspan="4">OBJECTIVE</th></tr>
<tr><td colspan="4">• To equip students with factual knowledge that will enable them to learn the history of Bangladesh.
• To trace the historical roots of Bangladesh as an independent state focusing on the social, cultural and economic development those have taken place since its independence.
• To promote an understanding of the development of Bangladesh and its culture.
• To create an awareness among the students about the Geography, Economy, Politics and Culture of Bangladesh.</td></tr>
<tr><th colspan="4">COURSE CONTENT</th></tr>
<tr><td colspan="4">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, Political Development and Democratic Transition (1971-1990), Political Development (1991- Present), Bangladesh's contribution to world peace and its security.
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</td></tr>
</table>

Literature, Main traditional cultural events, Vision-2021, Digitalization, Tourism and Natural Resources, Bangladesh and International Relations.
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	**Identify** specific stages of Bangladesh's political history, through the ancient, medieval, colonial and post-colonial periods and critically **analyze** plurality of cultural identities of Bangladesh.						√						
2	**Explain** the economy and patterns of economic changes through qualitative and quantitative analysis.						√						

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Identify** specific stages of Bangladesh's political history, through the ancient, medieval, colonial and post-colonial periods and critically **analyze** plurality of cultural identities of Bangladesh.	6	C1, C2	-	-	1	Class Test/Mid Term Exam/Final Exam

CO2	**Explain** the economy and patterns of economic changes through qualitative and quantitative analysis.	6	C2	-	-	1	Class Test/Mid Term Exam/Final Exam

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning	
Lecture (2 hours/week x 14 weeks)	28
Guided Learning	
Assignment Preparation	-
Independent Learning	
Individual learning	56
Preparation for quiz and final exam	14
Assessment	
Continuous assessment (Assignment/ Class Test)	01
Mid-Term	01
Final Exam	03
Total	103

TEACHING METHODOLOGY

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

TEACHING SCHEDULE

Week	Topics	Remarks
1	Bangladesh Geography: Location, Area, Boundary, Physiography, River System, Forest and Climate. The People of Bangladesh, Demography of Bangladesh.	Class Test, Final Exam
2	History: Overview of the ancient Bengal; anthropological identity of the Bengali race: main trends in the history of medieval Bengal	
3	Bengal under the East India Company; religious and social reform movements; nationalist movements, division of the Indian sub-continent	
4	Language movement 1948-1952; education movement of 1962; six-point movement of 1966: mass uprising of 1969	

5	War of independence and emergence of Bangladesh in 1971	Class Test, Final Exam
6	Constitution of Bangladesh, Political Development and Democratic Transition (1971-1990)	
7	Political Development (1991-Present), Bangladesh's contribution to world peace and its security	
8	Environment, Economy and Culture: Land, Characteristics of tropical monsoon climate, Forests and biomass, Engineering development in Bangladesh (Kaptai Dam, Padma bridge, power plants, Karnaphuli River Tunnel etc) and its impact on socio-economic aspect	Mid Term, Final Exam
9	Fish, Minerals, Health, Education, Agriculture, Industries, NGOs, Population, Sociological and Cultural aspects of Bangladesh	
10	Economy and National development, Development and Progress of the Millennium Development Goals (MDGs), Public Administration in Bangladesh, State of Good Governance in Bangladesh	
11	Art and Literature, Main traditional cultural events	Class Test, Final Exam
12	Vision-2021, Digitalizaiton, Tourism and Natural Resources	
13	Bangladesh and International Relations	
14	Revision	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Class Test/Class Assignment/Mid Term	40%	CO1, CO2	C1, C2
Final Exam	60%	CO1, CO2	C1, C2
Total Marks	100%		

REFERENCE BOOKS

1. Md. Shamsul Kabir Khan and Daulatunnahar Khanam, Bangladesh Studies.
2. The Constitution of the People's Republic of Bangladesh.
3. Akbar Ali Khan, Discovery of Bangladesh.
4. Sirajul Islam, History of Bangladesh, vols: 1-3.
5. R C Majumdar, History of Modern Bengal, vol: 1.
6. Dr. Abdul Mumin Chowdhury, Dynastic History of Bengal.
7. William Van Schendel, A History of Bangladesh.
8. Harun Er Rashid, Geography of Bangladesh.
9. Sirajul Islam, Banglapedia: National Encyclopedia of Bangladesh, vols: 1-10.
10. R. A. Chandra, History of Bengal (Mughall Period 1526-1765).
11. Nitesh Sengupta, Land of Two Rivers.
12. A History of Bangladesh: Cambridge University Press.

Sociology

Fall Semester: Level 1 Term II

COURSE INFORMATION			
Course Code Course Title	: GES 101 : Fundamentals of Sociology	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This course has been designed to understand the human inter-personal relationship and human psychology in the society and to apply this knowledge in the practical field as an engineer through the study of varied societies and cultures.

OBJECTIVE
• To learn basics, scopes and perspectives of sociology. • To understand societal and cultural issues in national, global and environmental context. • To synthesis between social problem and social satisfaction in real life.

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

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 basic nature, scope and perspective of sociology and the criteria of social research process and methodologies.	√											

2	**Apply** contextual knowledge to assess societal and cultural issues in national and global context and also environmental context for sustainable development.						√						
3	**Analyze** Social problem, social stratifications, socialism, capitalism and economic life and political issues.						√						

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** the basic nature, scope and perspective of sociology and the criteria of social research process and methodologies.	1	C1	-	-	1	Class Test/Class Assignment/Final Exam
CO2	**Apply** contextual knowledge to assess societal and cultural issues in national and global context and also environmental context for sustainable development.	6	C2	-	-	1	Class Test/Final Exam

CO3	**Analyze** Social problem, social stratifications, socialism, capitalism and economic life and political issues.	6	C2	-	-	2	Mid-Term Exam/Final Exam

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (2 hours/week x 14 weeks)	28
Guided Learning Assignment Preparation	-
Independent Learning Individual learning Preparation for quiz and final exam	56 14
Assessment Continuous assessment (Assignment/ Class Test) Mid-Term Final Exam	01 01 03
Total	103

TEACHING METHODOLOGY

Lecture and Discussion

TEACHING SCHEDULE

Week	Topics	Remarks
1	Definition, nature and scope of sociology, Sociological imagination	Class Test, Final Exam
2	Perspectives of sociology, Orientation of sociological theories	
3	Social research and its process, Research designs and techniques	
4	Introducing culture and its variations, civilization	
5	Defining family and its changes, Socialization process and development of self	Class Test, Final Exam

6	Introducing globalization and its impact on human life, Factors responsible to globalization	
7	Media and its impact in modern society, Addressing social problems of Bangladesh	
8	Introducing social groups and organizations, Introducing bureaucracy and good governance	Mid Term
9	Introducing social stratifications and social inequality, Poverty and its types and dimensions	
10	Industrial revolution and aftermath, Urbanization and city development	
11	Capitalism: features and influence, Socialism: features and influence	Class Test, Final Exam
12	Environment and human activities, Climate change and global risk	
13	Population of Bangladesh: problem or prospect, Crime and deviance: a brief analysis	
14	Review	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Class Test/Class Assignment/Mid Term	40%	CO1, CO2, CO3	C1, C2
Final Exam	60%	CO1, CO2, CO3	C1, C2, C2
Total Marks	100%		

REFERENCE BOOKS

1. Brinkerhoff, David B., Suzanne T. Ortega, and Rose Weitz. Essentials of sociology. Cengage Learning, 2013.
2. Rao, CN Shankar. "Sociology: Primary Principles." New Delhi: S. Chand and Company Ltd (2002).
3. Giddens, Anthony, ed. Human societies: an introductory reader in sociology. Cambridge, Eng.: Polity Press, 1992.

Principles of Accounting

Spring Semester: Level 2 Term I

COURSE INFORMATION			
Course Code Course Title	: GEA 201 : Principles of Accounting	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

The purpose of this course is to serve as an introduction to basics of accounting, analysis, recording, summarizing and reporting.

OBJECTIVE

- Understand the meaning, history and definition of accounting, the users and uses of accounting, importance of ethics in financial reporting.
- Understand the International Financial Reporting (IFRS), Generally Accepted Accounting Principles (GAAP), cost principle, monetary unit assumption and the economic entity assumption.
- Understand the worksheet, preparation of financial statements, cost benefit analysis of different projects with honesty and integrity.
- To provide the students with an in-depth knowledge of Management Accounting to enable them to apply its methods and techniques for preparing and presenting information for management decision-making and control purposes.
- Applying selected management accounting techniques and analyze the implications of the techniques with regards to cost-volume profit analysis, budgeting, standard costing and variance analysis.

COURSE CONTENT

Accounting in Action; Recording Process; Adjusting the Accounts and prepare financial statement; Financial Statement Analysis; Computerized Accounting System; Cost Concepts; Absorption costing and Variable costing; Job Order Costing and Process Costing; Short & Long-Term Decision-Making in Accounting.

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 cost principle, monetary unit assumption and the economic entity assumption and ethics in financial reporting for each and every project.	√											
2	**Understand** worksheet, preparation of financial statements, cost benefit analysis of different projects.	√											
3	**Acquire** knowledge of Management Accounting and **apply** it for preparing and presenting information for management decision-making and control purposes.		√										
4	**Apply and analyze** the cost-volume profit, budgeting, standard costing and variance analysis for any project.		√										

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** the cost principle, monetary unit assumption and the economic entity assumption and ethics in financial reporting for each and every project.	1	C2	-	-	1	Mid Term Exam/Final Exam

CO2	**Understand** worksheet, preparation of financial statements, cost benefit analysis of different projects.	1	C2	-	-	1	Class Test, Mid-Tern Exam
CO3	**Acquire** knowledge of Management Accounting and apply it for preparing and presenting information for management decision-making and control purposes.	2	C2	-	-	1	Class Test, Final Exam
CO4	**Apply and analyze** the cost-volume profit, budgeting, standard costing and variance analysis for any project.	2	C3	-	-	1	Class Test, Final Exam
WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile							

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (2 hours/week x 14 weeks)	 28
Guided Learning Assignment Preparation	 10
Independent Learning Individual learning Preparation for quiz and final exam	 24 13
Assessment Continuous assessment (Assignment/ Class Test) Mid-Term Final Exam	 01 01 03
Total	80

TEACHING METHODOLOGY
Lecture and Discussion

TEACHING SCHEDULE		
Week	**Topics**	**Remarks**
1	Meaning, history and definition of accounting	Class Test, Final Exam
	The users and uses of accounting.	
2	Ethics in financial reporting	
	The cost principle, monetary unit assumption and the economic entity assumption	
3	Accounting equation and its components	Class Test, Final Exam
	The effects of business transactions on the accounting equation.	
4	Four financial statements and how they are prepared.	
	Journal	Mid Term, Final Exam
5	Journal	
	T-account, Ledger, Trial balance	
6	Adjusting Accounts	
	Worksheet.	
7	Completion of the Accounting cycle.	Class Test, Final Exam
	Financial Statement Analysis	
8	Managerial Accounting Basics	
	Cost Concepts	
9	Job Order Cost Accounting	
10	Process Cost Accounting	
11	Cost-Volume-Profit Relationships	
12	Performance	
13	Incremental Analysis	
14	Capital Budgeting	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Class Test/Class Assignment/Mid Term	40%	CO1, CO2, CO3	C2, C2, C3
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C2, C3
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.

Engineering Economics

Spring Semester: Level 2 Term I

COURSE INFORMATION			
Course Code Course Title	: GEE 201 : Engineering Economics	Lecture contact hours Credit hours	: 2.00 : 2.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This course is designed for the students to develop their competence in engineering economic analysis and its role in problem solving.			
OBJECTIVE			
• Students will demonstrate their knowledge of the fundamental and technical concepts of economics. • Students will be able to understand consumer behavior, elasticity and different market structure. • 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. • Students will apply the basic theories of economics in critical thinking and problem solving. • Students will be able to identify the basic features of economic development and regarding planning for the economy of the country.			
COURSE CONTENT			
Accounting in Action; Recording Process; Adjusting the Accounts and prepare financial statement; Financial Statement Analysis; Computerized Accounting System; Cost Concepts; Absorption costing and Variable costing; Job Order Costing and Process Costing; Short & Long-Term Decision-Making in Accounting.			

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 basic concepts and principles of Micro and Macro Economics.	√											

2	**Identify and apply** the indifference curve theory and market equilibrium in real life situation	√											
3	**Explain** time-value of money concept and **apply** the knowledge of inflation, investment and cost benefit analysis.		√										
4	**Understand** the Economic Development and Planning for the country. To get idea of international economy.	√											

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** the basic concepts and principles of Micro and Macro Economics.	1	C1	-	-	1	Class Test/Mid Term Exam/Final Exam
CO2	**Identify and apply** the indifference curve theory and market equilibrium in real life situation.	1	C1	-	-	1	Mid Term Exam/Final Exam
CO3	**Explain** time-value of money concept and **apply** the knowledge of inflation, investment and cost benefit analysis.	2	C2	-	-	2	Class Test/Mid Term Exam/Final Exam

CO4	**Understand** the Economic Development and Planning for the country. To get idea of international economy.	1	C2	-	-	1	Class Test/Final Exam

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning	
Lecture (2 hours/week x 14 weeks)	28
Guided Learning	
Assignment Preparation	10
Independent Learning	
Individual learning	24
Preparation for quiz and final exam	13
Assessment	
Continuous assessment (Assignment/ Class Test)	01
Mid-Term	01
Final Exam	03
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Remarks
1	Introduction to Engineering Economics Importance of Economics in Engineering.	Class Test, Final Exam
	Definition of economics, Difference between micro and macroeconomics. Production possibility frontier (PPF) and Engineering choice.	
2	Demand and determinants of Demand	

	Demand curve related basic idea and Mathematical Application	
3	Supply and Determinants. Market Mechanism.	Class Test, Final Exam
	Consumer Choice (Indifference Curve and Budget Line)	
4	Indifference Curve, Properties of IC, MRS	
	Theory of production in the point of view of Engineers	Mid Term, Final Exam
5	Theory of cost, Short run and long run cost curve	
	Firms Equilibrium (Concepts)	
6	Different types of Market.	
	How the Engineers will act in perfectly competitive market.	
7	How the Engineers will act in Monopoly Market	
	National Income analysis	
8	Aggregate Demand and Aggregate Supply	
	Determination of Level of Income and Employment	
9	Keynes Full Employment. Theory	
	Circular flow of Income and Expenditure (How engineers will utilize the resources and decision-making process of project plan)	
10	Consumption Function	Class Test, Final Exam
	Saving Function	
11	Inflation, Type of Inflation	
	Impact of Inflation	
12	Unemployment problem and its impact on society	
	Cost benefit analysis	
13	Theories of Economic Development	
	Economic Problems in Developing Countries	
14	Contribution of the Engineers in the Economic Development of Bangladesh.	
	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	C1, C2
Final Exam	60%	CO1, CO2, CO3, CO4	C1, C2
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)

Leadership and Management

Fall Semester: Level 2 Term II

COURSE INFORMATION			
Course Code Course Title	: GELM 275 : Leadership and Management	Lecture contact hours Credit hours	: 2.00 : 2.00

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.

- To introduce different management functions and approaches.
- To expose students to different views and styles of leadership.
- To understand how an organization functions collaboratively with managers and engineers.
- To understand various personality traits and its impact on leadership and management.
- To solve real-world management problems as an engineer.

COURSE CONTENT

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.

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	**Familiarize** with the fundamental concepts of leadership and management skills.									√			
2	**Understand** the role and contribution of a leader in achieving organizational goals.									√			

3	**Understand** the contribution of leadership traits and management skills in decision making and solving real life problems.											√	

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Familiarize** with the fundamental concepts of leadership and management skills.	9	C1, C2	-	-	1	Class Test/Mid Term Exam/Final Exam
CO2	**Understand** the role and contribution of a leader in achieving organizational goals.	9	C1, C2	-	-	1	Mid Term Exam/Final Exam
CO3	**Understand** the contribution of leadership traits and management skills in decision making and solving real life problems	11	C1, C2	-	-	1	Class Test/Mid Term Exam/Final Exam
WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile							

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (2 hours/week x 14 weeks)	28
Guided Learning Assignment Preparation	-
Independent Learning	

Individual learning Preparation for quiz and final exam	56 14
Assessment Continuous assessment (Assignment/ Class Test) Mid-Term Final Exam	 01 01 03
Total	103

TEACHING METHODOLOGY

Lecture and Discussion

TEACHING SCHEDULE

Week	Topics	Remarks
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 Test, Final Exam
	Management Fundamentals: Definition of management & manager; levels of management; management functions and skills; Mintzberg's managerial roles; Henri Fayol's management principles; strategic management.	
2	**Leadership & Motivation**: Motivation, Maslow's hierarchy needs; theory of X & Y; motivators and hygiene factors; goal setting theory; reinforcement theory; equity theory; expectancy theory	
3	**Leadership:** Leadership styles; leadership trait theory; managerial grid; contemporary leadership; conflicts negotiation; leadership issues in 21st century; cross cultural leadership; engineer as a leader and some simple case discussions on leadership (positive and toxic leadership) in the class (Interactive Learning).	
4	**Case Study – I: Engineer as Great Leaders**	Class Test, Final Exam
5	**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.	
6	**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.	
7	**Case Study – II : Planning and Goal Setting; A Managerial Approach: Engineer as Great Managers (Interactive Discussions in the Class)**	Mid-Term Exam
	Attitude: Components of Attitude; behavior model and characteristics model; behavior vs. attitude; job attitude; job involvement; job satisfaction and customer satisfaction.	
8	**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	
9	**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.	
	Case Study – III : A Case on Decision Making – Involves both leadership and managerial skills (Interactive Discussion in the Class)	
10	**Understanding Work Team:** Work group; work team; problem solving team; self-managed work team; cross functional team; virtual team; team effectiveness; team challenges.	
	HR Management: Process of Human Resource Planning; forecasting demand for labor; staffing.	
11	**HR Management:** Internal supply of labor; performance appraisal.	Class Test, Final Exam
	Operations Management: Project managing basics; goals and boundary of project; WBS; scheduling a project.	
12	**Operations Management:** Demand and supply forecasting; inventory control.	
	Exercise – Use of Microsoft Project (MSP) for scheduling a project at student level	
13	**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)	
14	**Information Technology and Management:** Management Information System (MIS); Enterprise Resource Planning (ERP) - For introductory knowledge.	
	Revision	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Class Test/Class Assignment/Mid Term	40%	CO1, CO2, CO3	C1, C2, P1, P2
Final Exam	60%	CO1, CO2, CO3	C1, C2, P1, P2
Total Marks	100%		

REFERENCE BOOKS

1. Engineering Management by A K Gupta.
2. Industrial Engineering and Production Management by Martand T Telsand.
3. Leadership in Organizations by Gary Yukl.
4. Developing Management Skills by David A Whetten and Kim S Cameron.

Project Management and Finance

Fall Semester: L-4, T-II

COURSE INFORMATION			
Course Code Course Title	: GEPM 401 : Project Planning and Construction Management	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This course provides 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			
• To gain knowledge on principles of project management & organizations, conflict management, human resource management, inventory management, demand forecasting and construction site management • To develop skills for evaluating a project based on BCR, NPV, IRR, PBP • 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. 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
1	Ability to **explain** principles of project management & organizations, human resource management, inventory management, demand forecasting and construction site management		√										
2	Ability to **plan** a project schedule by network techniques and project management software and **execute** allocation of resources by linear programming			√									
3	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 & organizations, human resource management, inventory management, demand forecasting and construction site management	1, 2	C1/C2	1, 2	-	3	Class Test, Assignment, Mid-term, 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	**Topics**	**Assessments**
1	Definition and characteristics of a project	CT/ Assignment
	Principles of Project Management	

	Principles of Project Management	
2	Feasibility study, feasibility report	
	Introduction to Construction Planning and Management	
	Project Organization: Methods and Practices, Technology	
3	Project life, time value of money, compounding and discounting formulas	
	Project Organization: Methods and Practices, Technology	
	Project Team	
4	PBP, NPB	CT/ Assignment
	Project Leadership	
	Motivation	
5	BCR, IRR	
	Project Communication	
	Management of Materials and Equipment	
6	Project planning, WBS, network technique	Mid Term/ Assignment
	Site Management	
	Contracts and Specifications	
7	CPM, Project Planning software	
	Illustrative example with CPM, Project Planning software	
	Inspection and Quality Control	
8	PERT	
	Illustrative example with PERT	
	Safety	
9	Crashing and network to find the optimum duration	
	Illustrative example for crashing a network	
	Economy	
10	Introduction to Linear Programing, formulation of objective function, constraint equations	
	Graphical solution of linear programming	
	Project Risk management	
11	Illustrative examples of graphical methods	
	Illustrative examples of graphical methods	
	Project Risk management	
12	Inventory management	CT/ Assignment
	EOQ	
	Conflict Management	
13	Demand Forecasting	

	Methods of Demand Forecasting	
	Psychology in Administration	
14	Construction safety, ethics, procurement	
	Human Factors in Management	
	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.
5. Construction Planning, Equipment and Methods by – Peurifoy
6. Material Management & Inventory Control by – A.K. Datta
7. Project Management by – S. Chowdhury

Ethics and Professional Practices

Fall Semester: L-4, T-II

COURSE INFORMATION			
Course Code Course Title	: CE 403 : Engineering Ethics and Professional Practices	Lecture contact hours Credit hours	: 2.00 : 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			
• To have a clear idea about different phases of a project. • To comprehend basic knowledge on claims arbitration. • To understand code of Ethics in engineering profession. • To gain knowledge on types of contracts, public procurements rules & regulations • Development of basic skills on preparation of development project proposal (DPP) • 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 & 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: 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.			

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	Ability to **ascertain** the essential elements required at different phases of a project.											√	
2	Ability to **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	Ability to **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 learning) Preparation for tests and examination	24 13
Assessment Continuous Assessment Final examination	 2 3
Total	80

TEACHING METHODOLOGY

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

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Introduction to the code of ethics for engineers	Class Test/ Final Exam
	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	Class Test/ Final Exam
	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/ Final Exam
	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	Class Test/ Mid Term/ Final Exam
	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	40%	CO1, CO2, CO3	C2, C3, C4

(Class assignments/ CT/ Mid Term/ Active Class Participation)			
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 opf 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 Choudhury
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
13. Bangladesh Arbitration Act 2001

Research Methodology

Spring Semester: L-3, T-I

COURSE INFORMATION			
Course Code	: GERM 352	Lecture Contact Hours	: 4.00
Course Title	: Fundamentals of Research Methodology	Credit Hours	: 2.00
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.			
OBJECTIVES			
• To evaluate/review related extant literature, form a variety of sources, pertinent to the research objectives/questions. • To expose students to various research methodologies (design), relevant to the research problem needing to be addressed. • To explain and justify how researchers will collect and analyze research data. • To educate students in the common mistakes, research misconduct, and ethical considerations in the field of research methodology.			
COURSE CONTENT			
Foundations of Research, Problem Identification and Formulation, Research Design, Data Analysis, Research Misconduct and Ethics, Use of Tools/Techniques for Research, Time management skills and developing Gantt Chart for proper planning and execution of research work.			

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 research fundamentals and **formulate** problem statement and research questions/objectives.		√										
2	**Formulate** and **compose** a Research proposal considering research activities, background studies, and following standard guidelines.			√									√
3	**Develop** writing and presentation skill, and **demonstrate** ethical considerations in conducting research.							√		√			

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** the research fundamentals and **formulate** problem statement and research questions/objectives.	2	C2	-	A1	-	Assignment, Class Test
CO2	**Formulate** and **compose** a research proposal considering research activities/design, background studies,	3, 12	C3	-	A3	-	Report, Project, Assignment, Class Test

	and following standard guidelines.						
CO3	**Develop** writing and presentation skill, and **demonstrate** ethical considerations in conducting research.	8, 10	C3	-	A1	-	Report, Project, Assignment

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning	-
Lecture	24
Practical / Tutorial / Studio	12
Student-Centered Learning	12
Guided Learning	-
Assignment Preparation	-
Independent Learning	-
Individual learning	12
Preparation for Report	18
Assessment	
Continuous assessment	1.5
Report Submission	-
Presentation	0.5
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Learning (PBL), Mini-Seminars by Experts

TEACHING SCHEDULE

Weeks	Topics	Remarks
1	Foundations of Research: Meaning of Research; Definitions of Research; Objectives of Research; Motivation in Research; General Characteristics of Research; Criteria of Good Research; Types of Research; Concept of theory, empiricism, deductive and inductive theory; Characteristics of scientific method.	

<table>
<tr><td>2</td><td>Practice session on Foundations of Research</td><td></td></tr>
<tr><td>3</td><td>Problem Identification & Formulation: Meaning & need of Review of Literature; How to Conduct the Review of literature; Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance.</td><td rowspan="2">Continuous Assessment (presentation/ quiz/other assignment)</td></tr>
<tr><td>4</td><td>Practice session on Problem Identification & Formulation</td></tr>
<tr><td>5</td><td>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.</td><td></td></tr>
<tr><td>6</td><td>Practice session on Research Design</td><td rowspan="2">Assignment 1 Assignment has to provide before, here students will submit report and give PPT</td></tr>
<tr><td>7</td><td>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.</td></tr>
<tr><td>8</td><td>Practice session on Data Analysis</td><td></td></tr>
<tr><td>9</td><td>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.</td><td></td></tr>
<tr><td>10</td><td>Practice session on Research misconduct and Ethics</td><td rowspan="3">Continuous Assessment (presentation/ quiz/other assignment)</td></tr>
<tr><td>11</td><td>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.</td></tr>
<tr><td>12</td><td>Practice session on Use of tools / techniques for Research</td></tr>
<tr><td>13</td><td>Review Session (Theory) – I /Final Presentation</td><td rowspan="2">Assignment 2 Assignment has to provide before, here students will submit report and give PPT</td></tr>
<tr><td>14</td><td>Review Session (Practice) – II /Final Presentation</td></tr>
</table>

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Assignment I	20%	CO1, CO3	C2, C3
Assignment II	50%	CO2, CO3	C2, C3
Continuous Assessment	30%	CO1, CO2	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. Engineering Research Methodology: A Practical Insight for Researchers. Springer, by Deb, Dipankar, Dey, Rajeeb, Balas, Valentina E.
2. Research Methods for Engineers, 1st Edition, by David V. Thiel.
3. Handbook of Research Methodology by Talati, J.K.
4. Introducing Research Methodology: A Beginner's Guide to Doing a Research Project by Uwe Flick
5. DRM, a Design Research Methodology by Lucienne T.M. Blessing and Amaresh Chakrabarti
6. Research Methods: Information, Systems, and Contexts by Kirsty Williamson, Graeme Johanson
7. 7. Zelkowitz, M. V. and Wallace, D. R. (1998), Experimental models for validating technology, Computer, vol. 31, no. 5, pp. 23-31.
8. Internet, mail, and mixed-mode surveys: the tailored design method (3rd ed.) by Dillman, D. A., Smyth, J. D., & Christian, L. M.
9. Improving survey questions: design and evaluation. Sage Publications, by Fowler, F. J.
10. Applied multiple regression/correlation analysis for the behavioral sciences (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates, by Cohen, J., Cohen, P., West, S., & Aiken, L.
11. Experimental and Quasi-Experimental Design for Generalized Causal Inference. Boston, Mass: Houghton Mifflin, by Shadish W.R., Cook T.D. & Campbell P.T.
12. Computational handbook of statistics (4th ed.). New York: Longman, by Bruning, J. L. & Kintz, B. L.

5.4: Language

Communicative English I

Fall semester: L-1 T-II

COURSE INFORMATION			
Course Code Course Title	: LANG 102 : Communicative English -I	Lecture Contact Hours Credit Hours	: 3.00 : 1.50
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			

SYNOPSIS/RATIONALE

The English language course is designed for the students to develop their competence in communication skills for academic purposes emphasizing in speaking, reading, listening and writing. The approach will be communicative and interactive and will involve individual, pair and group work. Students will be exposed to 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.

OBJECTIVES

- To develop the four basics skills of English language, i.e. listening, speaking, reading and writing.
- To develop students' interpersonal skills engaging them in various group interactions and activities.
- To improve students' pronunciation in order to improve their level of comprehensibility in both speaking and listening.
- To give the students exposure to different types of texts in English in order to make them informed using different techniques of reading.
- 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 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.

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	**Listen, understand and speak** English quickly and smartly using the technics learnt in the class.	√											
2	**understand** the techniques of academic reading and academic writing	√											
3	**Communicate effectively** within the shortest possible time to present ideas and opinions.										√		
4	**Develop** competency in oral, written communication/ presentation.										√		

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Listen, understand and speak** English quickly and smartly using the technics learnt in the class.	PO1	C2	-	-	1	Assignment, Quiz
CO2	**understand** the techniques of academic reading and academic writing	PO1	C3	-	-	1	Project/ Assignment, Quiz
CO3	**Communicate effectively** within the shortest possible time to present ideas and opinions.	PO10	C4	-	-	1	Project, Assignment, Quiz
CO4	**Develop** competency in oral, written communication/ presentation.	PO10	C5	-	-	2	Project/ Assignment, Quiz
WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile							

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	- 42 42
Guided Learning Assignment Preparation	30 -
Independent Learning Individual learning	- -

Preparation for Report	
Assessment Continuous assessment Report Submission Presentation	 04 - -
Total	88

TEACHING METHODOLOGY

Lecture and Discussion, Tutorial, Assignment, Report

TEACHING SCHEDULE

Week	Topics	Remarks
1	Introduction to Language: Introducing basic skills of language; English for Science and Technology	Assignment, Project, Quiz
	Self-introduction and introducing others: How a speaker should introduce himself to any stranger / unknown person / a crowd; Name, family background, education, experience, any special quality/interest, likings/disliking, etc.	
	Self-introduction and introducing others: How a speaker should introduce himself to any stranger / unknown person / a crowd; Name, family background, education, experience, any special quality/interest, likings/disliking, etc.	
2	Asking and answering questions, Expressing likings and disliking; (food, fashion etc.) Asking and giving directions	
3	Discussing everyday routines and habits, making requests/ offers/ invitations/ excuses/ apologies/ complaints	
4	Describing personality, discussing and making plans (for a holiday or an outing to the cinema), Describing pictures / any incident / event	
5	Practicing storytelling, Narrating personal experiences/Anecdotes	
6	Telephone conversations (role play in group or pair); Situational talks / dialogues: Practicing different professional conversation (role play of doctor-patient conversation, teacher –student conversation)	
7	Listening and understanding: Listening, note taking and answering questions; Students will listen to recorded text, note down important information and later on will answer to some questions	
8	Difference between different accents: British and American accents; Documentaries from BBC and CNN will be shown and students will try to understand	
9	Listening to short conversations between two persons/more than two	
10	Reading techniques: scanning, skimming, predicting, inference;	
11	Reading techniques: scanning, skimming, predicting, inference;	

12	Introductory discussion on writing, prewriting, drafting;	
13	Topic sentence, paragraph development, paragraph structure, describing a person/scene/picture, narrating an event	
14	Paragraph writing, Compare-contrast and cause- effect paragraph	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment Descriptive writing Reading Test Listening Test Public Speaking	20% 15% 15% 20%	CO1, CO2, CO3, CO4	C2, C3, C4, C5
Group Presentation	30%	CO1, CO2, CO3, CO4	C2, C3, C4, C5
Total Marks	100%		

REFERENCE BOOKS

1. Langan, J. (2005). College Writing Skills with Readings (6th Ed). McGraw-Hill Publication.
2. Interactions 1 (Reading), John Langan, Latest edition, McGraw-Hill Publication
3. Jones, L. (1981). Functions of English. (Student's Book, 2nd Ed.) Melbourne, Australia: Cambridge University Press.
4. Dixon, R.J. (1987). Complete course in English. (Book 4). New Delhi, India: Prentice Hall of India. (For book presentation).
5. From Paragraph to Essay - Maurice Imhoof and Herman Hudson Headway Series – Advanced Level (2 parts with CDs): Oxford University Press Ltd.
6. Speak like Churchill stand like Lincoln - James C. Humes.
7. Cambridge IELTS Practice Book.
8. Selected Sample Reports and Selected Research Articles.

Communicative English II

Spring semester: L-2 T-I

COURSE INFORMATION			
Course Code Course Title	: LANG 202 : Communicative English -II	Lecture Contact Hours Credit Hours	: 3.00 : 1.50
PRE-REQUISITE			
LANG 102			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
The English language course is designed for the students to develop their competence in communication skills for academic purposes 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.			
OBJECTIVES			
• To develop English language skills to communicate effectively and professionally. • To strengthen students' presentation skills. • To develop competency in academic reading and writing.			
COURSE CONTENT			
Reading: Reading Comprehension: Practice using different techniques Academic reading: comprehension from departmental or subject related passages Vocabulary for Engineers (some common Engineering terms for both general and dept specific) Reading subject specific text to develop vocabulary **Writing:** Writing semi-formal, Formal/official letters, Official E-mail Applying for a job: Writing Cover Letter and Curriculum Vitae Essay writing: writing steps, principles and techniques, outlining, revising, editing, proofreading; Narrative and descriptive writing: comparison-contrast and cause – effect, argumentative and opinion expression, assignment writing; Analyzing and describing graphs or charts Practicing analytical and argumentative writing **Speaking:** Public Speaking: Basic elements and qualities of a good public speaker Set Speech and Extempore Speech: How to get ready for any speech – set or extempore. Individual / Group			

presentation: How to be ready for presentation, prepare 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.

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 techniques of academic reading and become familiar with technical vocabularies.	√											
2	**Understand** the techniques of effective academic writing such as research article/report writing.	√											
3	**Communicate** effectively within the shortest possible time to present their reports and research work.										√		
4	**Analyze** any problem critically, analyze and interpret data and synthesize information to provide valid conclusions.										√		

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** the techniques of academic reading and become familiar with technical vocabularies.	PO1	C2	-	-	1	Assignment, Quiz
CO2	**Understand** the techniques of effective academic writing such as	PO1	C3	-	-	1	Project/ Assignment, Quiz

	research article/report writing.						
CO3	**Communicate** effectively within the shortest possible time to present their reports and research work.	PO10	C4	-	-	1	Project, Assignment, Quiz
CO4	**Analyze** any problem critically, analyze and interpret data and synthesize information to provide valid conclusions.	PO10	C5	-	-	2	Project/ Assignment, Quiz

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

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	- 42 42
Guided Learning Assignment Preparation	30 -
Independent Learning Individual learning Preparation for Report	- -
Assessment Continuous assessment Report Submission Presentation	04 - -
Total	88

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	**Topics**	**Remarks**
1	Reading Comprehension: Practice using different techniques	

2	Academic reading: comprehension from departmental or subject related passages	Assignment, Project, Quiz
3	Vocabulary for Engineers (some common Engineering terms for both general and dept specific) Reading subject specific text to develop vocabulary	
4	Writing semi-formal, Formal/official letters, Official E-mail	
5	Applying for a job: Writing Cover Letter and Curriculum Vitae Practicing storytelling, Narrating personal experiences/Anecdotes	
6	Essay writing: writing steps, principles and techniques, outlining, revising, editing, proofreading;	
7	Narrative and descriptive writing: comparison-contrast and cause – effect, argumentative and opinion expression, assignment writing;	
8	Analyzing and describing graphs or charts	
9	Practicing analytical and argumentative writing	
10	Public Speaking: Basic elements and qualities of a good public speaker	
11	Set Speech and Extempore Speech: How to get ready for any speech – set or extempore.	
12	Individual / Group presentation: How to be ready for presentation, prepare script for good speech, preparing power point slides, etc. Selected books/Selected stories for presentation.	
13	Listening to long lecture on some topics	
14	Listening and understanding speeches/lectures of different accents	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment Class participation Writing Test Reading Test Listening Test Public Speaking	 - 20% 15% 15% 20%	CO1, CO2, CO3, CO4	C2, C3, C4, C5
Group Presentation	30%	CO1, CO2, CO3, CO4	C2, C3, C4, C5
Total Marks	100%		

REFERENCE BOOKS
1. 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 h. Selected Sample Reports and Selected Research Articles.

5.5 Interdisciplinary Courses (EECE, PME, CSE, ARCH)

Basic Electrical Engineering offered by EECE Department

Fall semester: L-I T-1

COURSE INFORMATION			
Course Code	: EE 165	Lecture Contact Hours	: 3.00
Course Title	: Basic Electrical Technology	Credit Hours	: 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To introduce the students with the fundamental concepts of DC and AC circuits, relevant components and theorems. The course is designed to give a brief introduction on the basics of network analysis of electrical and electronic circuits, electronic devices and electrical machines. It aims to build a strong foundation on electrical wiring system with a view to enabling the students to work efficiently in practical field and design efficient layouts for electrical wiring.

OBJECTIVES

- To familiarize the students with the basics of DC and AC circuit analysis.
- To impart knowledge on the working principle and applications of some common yet frequently used electronic devices.
- To introduce the students with the electrical machines that are in use enabling them to analyses the characteristics of the machines changing relevant parameters.
- To ensure that the students have the necessary knowledge of Electrical Wiring system to work efficiently in practical field.

COURSE CONTENT

Measurement of electrical quantities: Current, voltage, resistance,

Measuring instruments: Ammeter, voltmeter, watt meter and multimeter,

Laws of Electric Circuit: Ohm's law, Kirchhoff's voltage and current laws, Series, parallel equivalent circuit and Delta-wye transformation.

Electrical networks analysis: Branch and loop currents, node and mesh current analysis, Super position, Thevenin's and Norton's theorem,

AC circuit analysis: Instantaneous current, voltage and power, effective current and voltage, average power.

Introduction to Electronics devices with simple application: Diodes, Rectifiers.

Familiarization with different types of electrical machines: DC generators and motors, alternators, AC motors, transformers. Working principles of transformers and induction motors.

Electrical Wiring: Rules and Regulations, wiring for residential, industrial, commercial buildings, cost estimation for electrical wiring, illumination.

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	Be able to **apply** the concepts of DC and AC circuit analysis for solving relevant problems.	√											
2	Be able to **explain** the working principles of commonly used electrical machines and solve problems.	√											
3	Be able to **analyze** potential solution using network theorem.	√											
4	Be able to **design** efficient layouts for the wiring system of residential, commercial and industrial buildings.			√									

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Be able to **apply** the concepts of DC and AC circuit analysis for solving relevant problems.	PO1	C4	1	-	3	Class Test, Assignment, Final Exam
CO2	Be able to **explain** the working	PO1	C3	1	-	3	Mid Term/ Final Exam

	principles of commonly used electrical machines and solve problems.						
CO3	Be able to **analyze** potential solution using network theorem.	PO1	C2	-	-	3	Mid Term/ Final Exam
CO4	Be able to **design** efficient layouts for the wiring system of residential, commercial and industrial buildings.	PO3	C3	P2	-	5	Mid Term/ Project/ 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 Practical / Tutorial / Studio	42
Guided Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	42 21 21
Assessment Continuous assessment Final Quiz	2 3
Total	112
TEACHING METHODOLOGY	
Lecture followed by practical experiments and discussion.	

TEACHING SCHEDULE		
Week 1	**Topics**	**Assessment**
Class 1	Electricity, Electric element and components, Electric Circuit, Current (AC or DC), Voltage.	Class Test, Final Exam
Class 2	Power and energy, Active elements, Passive elements, Independent and Dependent source	
Class 3	Ohm's law, Resistor, Conductor, Insulator, Semi-conductor, Branch, Node, Loop, Mesh	
Week 2		
Class 4	Series-parallel connection	
Class 5	KCL, KVL, Analysis of equivalent resistance of electrical circuit	
Class 6	Analysis of voltage, current and power	
Week 3		
Class 7	Y to Δ conversion derivation	
Class 8	Analysis of electrical circuits with Y-Δ connection	
Class 9	Ammeter, Voltmeter, Wattmeter and Multimeter	
Week 4		Mid Term
Class 10	Su er node analysis	
Class 11	Various mathematical problems solving nodal analysis	
Class 12	Mesh Analysis	
Week 5		
Class 13	Network Theorems	
Class 14	Network Theorems	
Class 15	Magnetic Circuits	
Week 6		
Class 16	Introduction to AC, Reactive circuit components	
Class 17	Network theorems for AC circuit analysis	
Class 18	Network theorems for AC circuit analysis	
Week 7		
Class 19	Average and RMS values of current, voltage and power	
Class 20	Instantaneous Current, voltage and power for RC and RL circuits	
Class 21	Instantaneous Current, voltage and power for RLC circuits	
Week 8		Class Test, Final Exam
Class 22	Diode (Working principle)	
Class 23	Diode (Applications and mathematical problems)	
Class 24	Transistor	
Week 9		
Class 25	Transformer	
Class 26	DC generator	

Class 27	DC generator, DC motor	
Week 10		
Class 28	DC motor	
Class 29	Induction Motor	
Class 30	Alternator	
Week 11		
Class 31	Introduction to electrical wiring	
Class 32	Rules and Regulations for electrical wiring	Class Test, Final
Class 33	Electrical wiring for residential buildings	
Week 12		
Class 34	Electrical wiring for residential buildings	
Class 35	Electrical wiring for industrial buildings	
Class 36	Electrical wiring for industrial buildings	
Week 13		
Class 37	Electrical wiring for commercial buildings	
Class 38	Electrical wiring for commercial buildings	
Class 39	Cost estimation for electrical wiring of a building	
Week 14		
Class 40	Cost estimation for electrical wiring of a building	
Class 41	Introduction to illumination, Illumination for different types of building	
Class 42	Revision	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Continuous Assessment Class Test, Assignment, Class participation, Class Attendance, Mid Term Examination	40%	CO1, CO2, CO3, CO4	C2, C2, C3, C4
Final Exam	60%	CO1, CO2, CO3, CO4	C2, C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Introductory Circuit Analysis - R.L. Boylestad; Prentice Hall of India Private Ltd.
2. Alternating Current Circuits – Russell & George F. Corcoran; John Wiley and Sons.
3. A Textbook of Electrical Technology- B.L. Theraja and A.K. Theraja
4. Electrical Wiring, Estimating and Costing - S.L. Uppal; Khanna Publishers
5. Fundamentals of Electric Circuits – Charles Alexander and Mathew Sadiku

Basic Mechanical Engineering and Workshop Sessional offered by ME Department

Fall semester: L-I T-1

COURSE INFORMATION			
Course Code Course Title	: Shop 132 : Workshop Technology Sessional	Lecture Contact Hours Credit Hours	: 3.00 : 1.50
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To help the students to explore various welding techniques and put theory in practice. Our mission is to expose students to the constructions of different mechanical machines and analyze their performance. This course is targeted to verify the working principle of types of welding, casting, mouldings and also to gain knowledge of different manufacturing parts from lathe, drilling, milling and drilling machine etc. and relate them with their theoretical knowledge.			
OBJECTIVES			
• To use different manufacturing (machining, welding, foundry, sheet metal working, etc.) processes required to manufacture a product from the raw materials. • To use different measuring, marking, cutting tools used in workshop. • Be aware of the safety precautions while working in workshop.			
COURSE CONTENT			
Carpentry shop (3/2 hrs/week) Wood working tools; wood working machine: band saw, scroll saw, circular saw, jointer, thickness planner, disc sander, wood lathe; types of sawing; common cuts in wood works; types of joint; defects of timber: natural defects and artificial defects; seasoning; preservation; substitute of timber; commercial forms of timber; characteristics of good timber; use of fastening; shop practice: practical job, planning and estimating of a given job. **Machine shop (3/4 hrs/week)** Kinds of tools; common bench and hand tools; marking and layout tools, measuring tools, cutting tools, machine tools, bench work with job; drilling, shaper, lathe and milling machines: introduction, type, size and capacity, uses and applications. **Welding shop (3/4 hrs/week)** Methods of metal joints: Riveting, grooving soldering, welding; Types of welding joints and welding practice; Position of arc welding and polarity: Flat, vertical, horizontal, overhead; Electric Arc welding and its machineries; Welding of different types of materials: Low carbon steel, cast iron, brass, copper, stainless steel, aluminum; Types of electrode, fluxes and their composition; Arc welding defects; Test of Arc welding: Visual, destructive and non-destructive tests. Types of gas welding system and gas welding equipment; Gases and types of flame; welding of different types of materials; Gas welding defects; test of gas welding.			

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	Be able to **identify** the basics of tools and equipment used in machining, welding, casting and molding.	√											
2	Be able to **compare** between different types of welding and machining processes and select proper cutting tool for specific machining processes.		√										
3	**Find** out about the importance of general safety precautions on different shop floors.	√											
4	**Develop** practical skills using tools and equipment.					√							

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Be able to **identify** the basics of tools and equipment used in machining, welding, casting and molding.	PO1	C1	-	1	-	Report, Quiz, Lab Test
CO2	Be able to **compare** between different types of welding and machining processes and select proper	PO2, PO3	C1, C3	-	1	-	Report, Quiz, Lab Test

	cutting tool for specific machining processes.						
CO3	**Find** out about the importance of general safety precautions on different shop floors.	PO1	C2	-	-	-	Report, Quiz, Lab Test
CO4	**Develop** practical skills using tools and equipment.	PO5	C3	-	1	-	Report, Quiz, Lab Test

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning	
Lecture	14
Practical / Tutorial / Studio	28
Guided Learning	
Preparation of Lab Reports	10
Preparation of Lab Test	10
Preparation of presentation	5
Preparation of Quiz	10
Engagement in Group Projects	20
Independent Learning	
Individual learning	-
Preparation for Report	-
Assessment	
Continuous assessment	14
Final Quiz	1
Total	112

TEACHING METHODOLOGY

Lecture followed by practical experiments and discussion.

TEACHING SCHEDULE		
Weeks	**Topics**	**Remarks**
1	Design and making of pattern for casting	Report, Lab Test, Quiz
2	Mold making, casting and assembly of final project	
3	Study of electric arc welding	
4	Study of Resistance Welding/Spot Welding	
5	Study of Welding joints and welding positions	
6	Study of Gas Welding/cutting	
7	Study of TIG and MIG Welding	
8	Manufacturing of machine component by using Lathe machine	
9	Manufacturing of machine component by using Shaper machine	
10	Manufacturing of a machine component by using Milling Machine	
11	Manufacturing of a machine component by using Drilling Machine	
12	Carpentry: Middle Lap T Joint, Cross Lap Joint, Mortise and Tenon T joint, Bridle T Joint	
13	Viva	
14	Quiz Test	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment Lab Participation and Report	60%	CO1, CO2, CO3, CO4	C1, C3, C4
Lab Quiz	40%	CO1, CO2, CO3, CO4	C2, C3, C4
Total Marks	100%		

REFERENCE BOOKS

1. Machine Shop Practice – James Anderson, W. A. Chapman.
2. Callister W. D., Material Science & Engineering, John Wiley & Sons.

Computer Programing Sessional offered by CSE Department

Spring semester: L-I T-1

COURSE INFORMATION			
Course Code Course Title	: CSE 176 : Computer Programming Sessional	Lecture contact hours Credit hours	: 3.00 : 1.50

PRE-REQUISITE
None
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
This is a hand on training course for computer programming for civil engineers. In this course students will be given basic knowledge on algorithm, problem solving technique and how to apply this in a computer language program.
OBJECTIVE
To introduce students the basic concepts of C++ language and enable them to write simple correct programs
COURSE CONTENT
Programming concepts and algorithms; internal representation of data; elements of structured programming language: data types, operators, expressions, control structures, functions, pointers and arrays, input and output.

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** algorithmic thinking, problem-solving techniques to write clear, simple codes.	√											
2	**Use** built-in data types and different operators e.g., arithmetic, increment, decrement, assignment, relational, equality etc effectively.	√											

3	**Write** codes using control structures i.e., if, if/else, for, while, do/while etc for solving engineering problems.					√							

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** algorithmic thinking, problem-solving techniques to write clear, simple codes.	1	C2	1	-	1,3	Class Assessment/ Quiz
CO2	**Use** built-in data types and different operators e.g., arithmetic, increment, decrement, assignment, relational, equality etc effectively.	1	C2	2,3	-	3	Class Assessment/ Quiz
CO3	**Write** codes using control structures i.e., if, if/else, for, while, do/while etc for solving engineering problems.	5	C3	2,3	-	3	Class Assessment/ Quiz

WP= Washington

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning	
Lecture (2 hours/week x 12 weeks)	24
Class assessment (1 hours/week X09 weeks)	09

Guided Learning Assessment Preparation (1.0 hours/week x 09 weeks)	09
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for quiz	11 04
Assessment Quiz & Viva	03
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lectures	Topics	Assessments
1	1	Introduction of the course, Concept of Programming (what is C++, Compiling, Debugging, Running a small program etc)	Class Assessment
2	2	Data type, Variables and Constants	
3	3	Operators, System header files	
4	4	Loops (if, elseif) Decision making	
5	5	Loops (for) Decision making	
6	-	Mid Quiz	Quiz
7	6	Function	Class Assessment
8	7	Loops (while)	
9	8	Vector/array	
10	9	Multi-dimensional Arrays	
11	10	Data file handling	
12	11	String function and Practice Examples	
13	12	Pointer	
14	-	Final Quiz	Quiz

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Class Assessment	50%	CO1, CO2, CO3	C2, C3

Quiz & viva	50%	CO1, CO2, CO3	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. “Teach Yourself C” by Herbert Schildt
2. “Programming with C++” by John R Hubbard (Schaum’s Series)
3. “Introduction to Computer Science using C++” by Todd Knowlton
4. Introduction to C++ programming and Graphics” by C. Pozrikidis

Engineering Computation Sessional offered by CSE Department

Fall semester: L-2 T-II

COURSE INFORMATION			
Course Code Course Title	: CSE 274 : Engineering Computations Sessional	Lecture contact hours Credit hours	: 3.00 : 1.50

PRE-REQUISITE
None
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
This is a hand on training course for computer programming for civil engineers. In this course, students will be given knowledge to solve real life engineering problems using various numerical methods which will be useful later on in various projects.
OBJECTIVE
• To gain knowledge on the basics of computational programming tools. • To become skilled at the application of various numerical analysis.
COURSE CONTENT
Introduction to hi-level computational programming tools, application to numerical analysis: basic matrix computation, solving systems of linear equations, non-linear equations, differential equations, interpolation and curve fitting, numerical differentiation, numerical integration, application to engineering problems: solving problems related to mechanics, numerical solution of equation of motion etc.
COURSE OUTCOMES AND SKILL MAPPING

No.	COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Ability to **interpret** high level computational programming tools.					√							
2	Ability to **solve** systems of linear equations, Ordinary & Partial Differential equations.		√										

3	Ability to **interpret** high level computational programming tools.		√										

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **interpret** high level computational programming tools.	5	C3	1, 2	-	1, 2	Class Assessment /Quiz
CO2	Ability to **solve** systems of linear equations, Ordinary & Partial Differential equations.	2	C4	2	-	1, 2	Class Assessment /Quiz
CO3	Ability to **apply** numerical analysis to engineering problems.	2	C3	3	-	2, 3	Class Assessment /Quiz

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning	
Lecture (1.5 hours/week x 14 weeks)	21
Class assignment (1 hours/week X14 weeks)	14
Guided Learning	
Assignment Preparation (1.0 hours/week x 14 weeks)	14
Independent Learning	
Preparation for tests and examinations	

	06
Assessment Quiz	05
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Assessments
1	MATLAB Fundamentals	Class Assessment
2	MATLAB Fundamentals	
3	MATLAB Fundamentals	
4	Curve Fittings	
5	Numerical Differentiations & Integrations	
6	Numerical Differentiations & Integrations	
7	Mid-term Quiz	Quiz
8	System of Linear Equations	Class Assessment
9	Roots of the Equations	
10	Eigen Values	
11	Fourier Analyses	
12	Ordinary & Partial Differential Equations	
13	Ordinary & Partial Differential Equations	
14	Final Quiz	Quiz

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Assignment Report & Class Assessment	50%	CO1, CO2, CO3	C3, C4
Quiz	50%	CO 1	C3
		CO 2	C4
		CO 3	C3

Total Marks	100%		
REFERENCE BOOKS			
1. Numerical Methods for Engineers and Scientists – J. D. Hoffman 2. App. Numerical Methods with Matlab for Engrs and Scientists – S.C. Chapra. 3. Numerical Mathematical Analysis – James b. Scarborough 4. Introductory Methods of Numerical Analysis – S.S. Sastry 5. Numerical Methods for Scientific and Eng. Computation - Jain, Iyengar, Jain.			

Architectural Engineering and Planning Appreciation offered by ARCH Department

Fall semester: L-2 T-II

COURSE INFORMATION

Course Code Course Title	: CE 214 : Architectural, Engineering & Planning Appreciation	Lecture contact hours Credit hours	: 3.00 : 1.5

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This is a hand-on training course for civil engineers where students will gain perspective of basic design and functional flow of structures from the point of view architectural and planning consideration. The students will also be oriented with the mechanical and electrical components of civil curricula.

OBJECTIVE

- To understand Architecture and its relation to Civil Engineering
- To understand the Basic Design and Functional Flow
- To perceive the spaces and forms in Architecture
- To realize the relation between Architecture & Urban Planning
- To understand the mechanical and electrical component of civil engineering design

COURSE CONTENT

Basic Design, Understanding Architecture and its relation to Civil Engineering, Plan arrangement with special consideration in functional flow, lighting, ventilation and climatic aspects, Spaces & Forms in Architecture & Urban Design, Spatial Structures of Cities; Study with relevant examples from Composition, Fundamentals of electrical and mechanical components, Architecture and Urban Planning, Evolution of Architecture (Old to modern age).

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	Ability to **understand** fundamentals of architectural design	√											
2	Ability to **understand** Architecture and its relation to Civil	√											

	Engineering with relevant examples and case studies.												
3	Ability to **design** a limited and small-scale project			√									
4	Ability to **comprehend** societal, cultural, traditional, health, safety and similar issues in architectural design and engineering planning						√						

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** fundamentals of architectural design	1	C2	-	-	1	Quiz, Assignment
CO2	Ability to **understand** Architecture and its relation to Civil Engineering with relevant examples and case studies.	1	C2	-	-	3	Quiz, Assignment
CO3	Ability to **design** a limited and small-scale project	3	P1	1	-	5	Quiz, Assignment
CO4	Ability to **comprehend** societal, cultural, traditional, health, safety and similar issues in architectural design and engineering planning	6	C3	4	-	7	Quiz, Assignment

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (2 hours/week x 12 weeks)	24
Independent Learning Individual learning (1-hour lecture ≈ 0.5-hour learning) Preparation for tests and examination	12 6
Class Assessment/Group Work Quiz	12 6
Total	60

TEACHING METHODOLOGY

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

TEACHING SCHEDULE

Week	Topics	Assessments
1	Introduction to the course, Understanding Architecture &Its relation to Civil Engineering	Assignment/ Class Project and Final Exam
2	Basic Design Principles	
3	Principles of Architecture	
4	Principles of Architecture	
5	Evolution of Architecture.	
6	Introduction of FAR, FAR Calculation.	
7	Parking Layout in a Commercial High-rise Building	
8-11	Modern Architecture/City Planning: Architectural and City Planning Examples of Twentieth and Twenty First Century. (Residential Building, Exhibition Facility, Office Building, Housing Development)	
12	Orientation with mechanical and electrical components of building design	
13	Introduction to Urban Planning: Spatial Structures of Cities	

14	Review / site visit	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Continuous Assessment (Class participation/ Class project/ assignments)	30%	CO1, CO2, CO3, CO4	P1, C2, C3
Design Development/ Assignment	60%	CO 2	C2
		CO 3	P1
		CO 4	C3
Quiz	10%	CO2, CO3, CO4	C2, P1, C3
Total Marks	100%		

REFERENCE BOOKS

1. Architecture: Form, Space, and Order by Francis D. K. Ching
2. Towards a New Architecture by Le Corbusier
3. Architecture: Residential Drafting and Design by Clois E. Kicklighter Ed. D., W. Scott Thomas
4. A Visual Dictionary of Architecture by Francis D. K. Ching
5. Balkrishna Doshi: An Architecture for India By William J. R. Curtis

5.6 Basic Engineering

Spring SemesterL-1, T-I

COURSE INFORMATION			
Course Code Course Title	: CE 101 : Analytic Mechanics	Lecture contact hours Credit hours	: 3.00 : 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

- 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.
- To apprehend the problems involving friction and their real application (in a limited scale)
- To determine geometric properties like centorids of line, area and volume, Theorems of Pappus and Guldinus, Centre of pressure along with internal properties of object such as Rectangular and Polar Moment of Inertia and Radius of gyration of single and composite areas, Transfer formula, Product of Inertia, Moment of Inertia at inclined axis, maximum and minimum moment of inertia, Moment of Inertia of Masses.
- Solve different problems with the concept of linear Impulse and Momentum.

COURSE CONTENT (2021)

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

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	Ability to **understand** free body diagram of different types of rigid bodies.	√											
2	Ability to **apply** equations of equilibrium to analyze statically determinate rigid bodies.		√										
3	Ability to **estimate** the geometric properties like centroids, moment of inertia etc. of different objects.	√											
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	1	C3	1	-	3, 4	Class Test/ Assignment/

	centroids, moment of inertia etc. of different objects.						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 learning) Preparation for tests and examination	33 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	Lecture	Topics	Assessments
1	1	Resultant and Components of Forces	Assignment, Class Test, Mid-term,
	2	Types of Forces and Introduction to Coplanar Concurrent Forces	
	3	Centroids: Definitions of centroids, centre of mass and centre of gravity, Formulas of centroids for line, area and volume.	

2	4	Concept of Equilibrium	Pop quiz, Final Exam
	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)	
	12	Centroid of Arc of a Circle, Centroid of plane triangle, Centroid of sector of a circle, Centroid of area without axis of symmetry.	
5	13	Tutorial on Analysis of Truss/Frames	
	14	Concept of Moments	
	15	Centroid of a volume (right circle cone, cylinder, hemisphere etc.)	
6	16	Concept of Parallel Force System	
	17	Determination of Reaction Forces, Forces on Members of Frames	
	18	Centroid of composite area, Centroid of composite volume	
7	19	Tutorial on Determination of Reaction Forces, Forces on Members of Frames	
	20	Tutorial on Determination of Reaction Forces, Forces on Members of Frames	
	21	Theorem of Pappus and Guldinus, Center of Pressure	
8	22	Non-Concurrent, Non – Parallel, Coplanar Forces	
	23	Analysis of Truss by Method of Section	
	24	Practice problem related to Theorem of Pappus and Guldinus, Center of Pressure	
9	25	Concept of Rectangular and Polar moment of Area and radius of gyration, Parallel axis and perpendicular axis theorem (Transfer formula, rectangular to polar)	
	26	Tutorial on Analysis of Truss by Method of Section	
	27	Practice problems of Rectangular Moment of Inertia and radius of gyration with axis of symmetry (Rectangle, triangle etc)	
10	28	Tutorial on Non-Concurrent, Non – Parallel, Coplanar Forces	

	29	Practice problems of Rectangular Moment of Inertia and radius of gyration with axis of symmetry (Rectangle, triangle etc)	
	30	Maximum and Minimum Moment of Inertia by formula and Mohr’s circle	
11	31	Formula and practice problems (solid cylinder) for Moment of Inertia of Masses and radius of Gyration.	
	32	Concept of Friction and Belt Friction	
	33	Moment of Inertia about Inclined Axis, Product of Inertia	
12	34	Analysis of Wedges	
	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)	
	39	Moment of inertia of mass and practice problems (Sphere, thin disk, cone)	
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, CO4	C3
Total Marks	100%		

REFERENCE BOOKS

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

Fall SemesterL-1, T-2

COURSE INFORMATION

Course Code Course Title	: CE 103 : Surveying and Spatial Information Engineering	Lecture contact hours Credit hours	: 3.00 : 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

The purpose of this course is to introduce various surveying techniques for conducting land and hydrographic survey which will be useful in various projects in the later semesters and in their professional life.

OBJECTIVE

- To understand the measurement techniques used in land and hydrographic surveying.
- To develop a deep understanding on techniques, skills and modern tools necessary for surveying.
- To gain knowledge on remote sensing, spatial measurement and spatial information management.
- To gain knowledge on highway/railway curve setting techniques.
- To understand the background concept of contour map production.

COURSE CONTENT

Introduction to surveying, orientation with survey equipment and instruments, reconnaissance survey/project survey, Linear measurements, Traverse survey, Triangulation, Leveling, Contouring, Calculation of area and volumes, Curve and curve ranging: transition curves, super-elevation and vertical curves, Principles and problems of tachometry. Introduction to remote sensing, use and application of remote sensing, Introduction to photogrammetric survey, Acoustic measurements and investigations, hydrographic operations.

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	Ability to **understand** the working principles of various survey methods, equipment and tools for conducting	√											

	land and hydrographic survey and spatial information analysis												
2	Ability to **explain** the principles of various methods for curve settings and earth works calculation for highway/railway projects and understand the components survey		√										
3	Ability to **apply** different survey methods in solving engineering problems			√									

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** the working principles of various survey, equipment and tools for conducting land and hydrographic survey and spatial information analysis	1	C2/C3	1		1,2	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **explain** the principles of various methods for curve settings and earth works calculation for highway/railway projects and the components of project survey	2	C2/C3	1		1,2	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **apply** different survey methods in solving engineering problems	3	C3	3		3, 4	Class Test, Mid-term, Pop quiz, Final Exam

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

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, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Introduction to surveying	CT/Assignment/ Final Exam
	2	Tacheometry introduction and applicability, equipment for tacheometry	
	3	Introduction to remote sensing	
2	4	Introduction to remote sensing	
	5	Principle of stadia method, calibration of a tacheometer	
	6	Formulations for distance and elevation by tacheometry	
3	7	Reconnaissance survey/ Project survey	
	8	Reconnaissance survey/ Project survey	
	9	Use and application of remote sensing	
4	10	Reconnaissance survey/ Project survey	

	11	Linear measurements	CT/Assignment/ Final Exam
	12	Linear measurements	
5	13	Introduction to photogrammetric survey	
	14	Introduction to photogrammetric survey	
	15	Introduction to photogrammetric survey	
6	16	Traverse survey	Mid Term/ Assignment/ Final Exam
	17	Traverse survey	
	18	Traverse survey	
7	19	Levelling	
	20	Levelling	
	21	Levelling	
8	22	Levelling	
	23	Contouring	
	24	Contouring	
9	25	Triangulation	
	26	Different methods of curve setting for simple circular curve	
	27	Different types of curves, basic definitions of simple circular curve	
10	28	Curves and curve setting	
	29	Solving problems on curve setting	
	30	Transition curve: characteristics, superelevation, equilibrium cant and cant deficiency	
11	31	Length of transition curve, formulation of transition curve	
	32	Calculation of area	
	33	Calculation of area	
12	34	Calculation of area	

	35	Solving problems on transition curve	CT/ Assignment/ Final Exam
	36	Solving problems on transition curve	
13	37	Cubic parabola as vertical curves, basic definitions, different types of vertical curves	
	38	Solving problems on vertical curves	
	39	Acoustic measurements and investigations	
14	40	Acoustic measurements and investigations	
	41	Calculation of volume	
	42	Calculation of volume	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3
Final Exam	60%	CO 1	C2, C3
		CO 2	C2, C3
		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS

1. Surveying‖- Volume I, II, III by- Dr. B.C. Punmia (SI Units)
2. A Text book of Surveying by- M.A. Aziz & Shahjahan
3. Schaum's Outline of Introductory Surveying by Roy Wirshing and James Wirshing
4. Construction Surveying and Layout: A Step-By-Step Field Engineering Methods‖ by Wesley G. Crawford
5. Basic Surveying (4th edition) by Raymond Paul and Walter Whyte

Fall SemesterL-2, T-II

COURSE INFORMATION			
Course Code Course Title	: CE 201 : Engineering Materials	Lecture contact hours Credit hours	: 3.00 : 3.00

PRE-REQUISITE
None
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
It is a basic course for the students to learn the properties, manufacturing process and uses of construction materials. The course is intended to provide necessary knowledge to the students which will be useful in various projects in the later semesters and in their professional life.
OBJECTIVE
• To gain knowledge on the properties of various aggregates and construction materials. • To be able to identify the suitability of engineering materials for different types of construction works. • To develop an understanding on manufacturing process of bricks, cement etc. • To design concrete mix by appropriate methods.
COURSE CONTENT
Properties and uses of aggregates, brick, cement; sand, lime; concrete; concrete mix design; admixtures; wood structures and properties; shrinkage and seasoning; treatment and durability; mechanical properties; wood products; basic property of FRP composites and available FRP composite products; steel; aluminium; introduction to geo-textiles; definition of stress and strain; plane stress and strain condition; identification of strain components of elastic, elasto-plastic and elasto-visco-plastic materials; time dependent strain response of these materials due to different types of loadings; mathematical and simple rheological modelling for prediction of creep behaviour; ferro-cement: advantages and uses; corrosion and prevention of steel in RC structures; offshore structures; application of nano technology in cement and concrete; introduction to high performance material (i.e., green building materials, ECC etc).
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	Able to **identify** the suitability of engineering materials for different types of construction works.	√											

2	Ability to **Understand** the production process of engineering materials (Bricks, Cement etc.) and their uses in Bangladesh.		√										
3	**Demonstrate** their understanding of the basic of engineering materials.		√										
4	**Use** appropriate method to undertake basic design calculations for concrete mix.		√										

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Able to **identify** the suitability of engineering materials for different types of construction works.	1	C4	1, 2	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **Understand** the production process of engineering materials (Bricks, Cement etc.) and their uses in Bangladesh.	2	C2	2	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **Demonstrate** their understanding of the basic of engineering materials.	2	C2	5	-	3, 4	Assignment, Pop quiz

CO4	**Use** appropriate method to undertake basic design calculations for concrete mix.	2	C3	5	-	4	Class Test, Mid-term, Final Exam

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

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, Tutorial, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	**Lecture**	**Topics**	**Assessments**
1	1	Properties of Aggregates	CT/ Assignment/ Final Exam
	2	Uses of Aggregates	
	3	Properties and Uses of Aggregates	
2	4	Bricks- Quality, Constituents, Characteristics etc.	
	5	Brick- Tests, Types, Classifications, Use etc.	
	6	Brick- Manufacturing Process, Kilns etc.	
3	7	Cement- Properties	

	8	Cement- Different types and characteristics	
	9	Cement- Manufacturing process	
4	10	Sand- Source, Types, FM, Classification	CT/ Assignment/ Final Exam
	11	Sand- Classification, Use, test and bulking	
	12	Lime- Properties, Source, Production, Classification	
5	13	Lime- Hydraulicity, Calcination, Slaking, Use	
	14	Mortars- Types, Components, Functions, Properties, Uses	
	15	Mortars- Methods of mixing, Preparation, Types, Varieties, Curing etc.	
6	16	Concrete- Properties, Ingredients, Related Terminologies, Types	Mid Term/ Assignment/ Final Exam
	17	Concrete – Workability, Segregation, Bleeding, Strength, Porosity, Aggregate properties	
	18	Concrete- Mixing, Handling, Placing, Effect, Chemical reaction	
7	19	Concrete- Strength, Factors, Permeability, Curing, Testing	
	20	Concrete- Advances in concrete technology, Special types of concrete	
	21	Basic property of FRP composites and available FRP composite products	
8	22	Basic property of FRP composites and available FRP composite products	
	23	Steel; Aluminum	
	24	Stress and strain; plane stress and strain condition;	
9	25	Identification of strain components of elastic, elasto-plastic and elasto-visco-plastic materials	
	26	Time dependent strain response of these materials due to different types of loadings; mathematical and simple rheological modeling for prediction of creep behavior	
	27	Ferro-cement: advantages and uses	
10	28	Ferro-cement: advantages and uses	

	29	Corrosion and prevention of steel in RC structures; Offshore structures	
	30	Corrosion and prevention of steel in RC structures; Offshore structures	
11	31	Material for ground improvement	
	32	Application of nano technology in cement and concrete	
	33	Introduction to high performance material (ie., green building materials, ECC etc).	
12	34	Concrete Mix Design- Principles, Material requirement, Workability, Quality Control	CT/ Assignment/ Final Exam
	35	Concrete Mix Design-Design of low and medium strength concrete, Design of high strength concrete	
	36	Concrete Mix Design- Lightweight concrete, Mass concrete, High density concrete, Fly Ash Cement concrete,	
13	37	Concrete Mix Design- Design of concrete mixes according to British and American standard.	
	38	Admixtures- Properties, Effectiveness, Functions	
	39	Admixtures- Different types and uses	
14	40	Wood structures and properties; shrinkage and seasoning	
	41	Wood -treatment and durability	
	42	Wood- mechanical properties; wood products	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2	C2, C3, C4
Final Exam	60%	CO 1	C3, C4
		CO 2	C4
		CO 3	C2, C3
Total Marks	100%		

REFERENCE BOOKS
1. Engineering Materials (5th Ed.) Dr. M. A. Aziz. 2. Building Materials (4th Ed.) Gurcharan Singh 3. A text book of Engineering Materials (6th Ed.) G.J. Kulkarni 4. CONCRETE Microstructure, Properties, and Materials (4th Ed,) P. Kumar Mehta and Paulo J. M. Monterio 5. Design of Concrete Mixes (4th Ed.) N. Krishna Raju

Fall SemesterL-2, T-II

COURSE INFORMATION			
Course Code Course Title	: CE 205 : Numerical Methods for Engineering	Lecture contact hours Credit hours	: 3.00 : 3.00

PRE-REQUISITE
None

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

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

COURSE CONTENT

Fundamental of numerical computing (e.g. numerical model, convergence, accuracy and stability) and error estimation; system of liner equations (Cramer's rule, Gaussian Elimination, LU factorization, Error analysis for liner systems, Iterative methods- Jacobi Method, Gauss-Seidel iteration, convergence of Iterative methods; Eigen Value Problems); Solving non-liner equations (root findings - Bi-section method, Newton-Raphson Method, Method of False Position); Interpolations (Polynomial interpolation, Piecewise/cubic spline interpolation Lagrange interpolation, and Chebyshev interpolation); Numerical differentiation and Integration (trapezoid, Romberg, Gauss, adaptive quadrature); Numerical solution of Ordinary Differential Equation (Initial Value Problem: Euler Method, Modified Euler Method, Range-Kutta Method); Numerical solution of Ordinary Differential Equation (Boundary Value Problem: Finite difference method and Shooting method, convergence and stability); Least square approximation (parameter estimation and curve fitting); Optimization Method; Numerical solution of Partial Differential Equations.

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	Ability to **understand** the theoretical workings of various numerical techniques and to **solve** the engineering problems.	√	√										
2	Ability to **analyze** the distinctive characteristics of various numerical techniques and the associated error measures.			√									
3	Ability to **apply** the principles of various numerical techniques to solve distinctive numerical problems.			√									

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** the theoretical workings of various numerical techniques and to **solve** the engineering problems.	1, 2	C2/C3	1	-	1, 2	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **analyze** the distinctive characteristics of various numerical techniques and the associated error measures.	3	C4/C5	2, 4	-	3	Class Test, Mid-term, Pop quiz, Final Exam

CO3	Ability to **apply** the principles of various numerical techniques to solve distinctive numerical problems.	3	C3	3	-	3, 4	Class Test, Mid-term, Pop quiz, Final Exam
WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile							

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, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	**Lecture**	**Topics**	**Assessments**
1	1	Fundamentals of numerical computing (e.g. Numerical model, convergence, accuracy and stability)	CT/ Assignment/ Final Exam
	2	Fundamentals of numerical computing (e.g. Numerical model, convergence, accuracy and stability)	

	3	Solving system of linear equations (Cramer’s rule, Gaussian Elimination, LU factorization, Error analysis for linear systems, Iterative methods-Jacobi Methods; Eigen value Problems)	
2	4	Interpolations (Polynomial Interpolation, Piecewise/Cubic spline interpolation, Lagrange interpolation and Chebyshev interpolation)	
	5	Interpolations (Polynomial Interpolation, Piecewise/Cubic spline interpolation, Lagrange interpolation and Chebyshev interpolation)	
	6	Solving system of linear equations (Cramer’s rule, Gaussian Elimination, LU factorization, Error analysis for linear systems, Iterative methods-Jacobi Methods; Eigen value Problems)	
3	7	Least Square approximation (parameter estimation and curve fitting)	
	8	Least Square approximation (parameter estimation and curve fitting)	
	9	Solving system of linear equations (Cramer’s rule, Gaussian Elimination, LU factorization, Error analysis for linear systems, Iterative methods-Jacobi Methods; Eigen value Problems)	
4	10	Error estimations and optimization methods	CT/ Assignment/ Final Exam
	11	Error estimations and optimization methods	
	12	Solving system of linear equations (Cramer’s rule, Gaussian Elimination, LU factorization, Error analysis for linear systems, Iterative methods-Jacobi Methods; Eigen value Problems)	

5	13	Solving system of linear equations (Cramer's rule, Gaussian Elimination, LU factorization, Error analysis for linear systems, Iterative methods-Jacobi Methods; Eigen value Problems)	
	14	Solving system of linear equations (Cramer's rule, Gaussian Elimination, LU factorization, Error analysis for linear systems, Iterative methods-Jacobi Methods; Eigen value Problems)	
	15	Solving system of linear equations (Cramer's rule, Gaussian Elimination, LU factorization, Error analysis for linear systems, Iterative methods-Jacobi Methods; Eigen value Problems)	
6	16	Solving system of linear equations (Cramer's rule, Gaussian Elimination, LU factorization, Error analysis for linear systems, Iterative methods-Jacobi Methods; Eigen value Problems)	Mid Term/ Assignment/ Final Exam
	17	Solving system of linear equations (Cramer's rule, Gaussian Elimination, LU factorization, Error analysis for linear systems, Iterative methods-Jacobi Methods; Eigen value Problems)	
	18	Solving system of linear equations (Cramer's rule, Gaussian Elimination, LU factorization, Error analysis for linear systems, Iterative methods-Jacobi Methods; Eigen value Problems)	
7	19	Solving system of linear equations (Cramer's rule, Gaussian Elimination, LU factorization, Error analysis for linear systems, Iterative methods-Jacobi Methods; Eigen value Problems)	
	20	Solving system of linear equations (Cramer's rule, Gaussian Elimination, LU factorization, Error analysis for linear systems, Iterative methods-Jacobi Methods; Eigen value Problems)	

	21	Solving non-linear equations (Root Findings-Bi section method, Newton Raphson Method, Method of False position)	
8	22	Solving non-linear equations (Root Findings-Bi section method, Newton Raphson Method, Method of False position)	
	23	Solving non-linear equations (Root Findings-Bi section method, Newton Raphson Method, Method of False position)	
	24	Numerical differentiation and Integration (Trapezoid, Romberg, Gauss adaptive quadrature)	
9	25	Numerical differentiation and Integration (Trapezoid, Romberg, Gauss adaptive quadrature)	
	26	Numerical differentiation and Integration (Trapezoid, Romberg, Gauss adaptive quadrature)	
	27	Numerical differentiation and Integration (Trapezoid, Romberg, Gauss adaptive quadrature)	
10	28	Numerical differentiation and Integration (Trapezoid, Romberg, Gauss adaptive quadrature)	
	29	Numerical solution of Ordinary Differential Equation (Initial Value Problems: Euler Method, Modified Euler Method & Boundary value problem: Finite Difference Method and Shooting Method, Convergence and Stability)	
	30	Numerical solution of Ordinary Differential Equation (Initial Value Problems: Euler Method, Modified Euler Method & Boundary value problem: Finite Difference Method and Shooting Method, Convergence and Stability)	

11	31	Numerical solution of Ordinary Differential Equation (Initial Value Problems: Euler Method, Modified Euler Method & Boundary value problem: Finite Difference Method and Shooting Method, Convergence and Stability)	
	32	Numerical solution of Ordinary Differential Equation (Initial Value Problems: Euler Method, Modified Euler Method & Boundary value problem: Finite Difference Method and Shooting Method, Convergence and Stability)	
	33	Numerical solution of Ordinary Differential Equation (Initial Value Problems: Euler Method, Modified Euler Method & Boundary value problem: Finite Difference Method and Shooting Method, Convergence and Stability)	
12	34	Numerical solution of Ordinary Differential Equation (Initial Value Problems: Euler Method, Modified Euler Method & Boundary value problem: Finite Difference Method and Shooting Method, Convergence and Stability)	CT/ Assignment/ Final Exam
	35	Numerical solution of Ordinary Differential Equation (Initial Value Problems: Euler Method, Modified Euler Method & Boundary value problem: Finite Difference Method and Shooting Method, Convergence and Stability)	
	36	Numerical Solution of Partial Differentiation Equations	
13	37	Numerical solution of Ordinary Differential Equation (Initial Value Problems: Euler Method, Modified Euler Method & Boundary value problem: Finite Difference Method and Shooting Method, Convergence and Stability)	

	38	Numerical solution of Ordinary Differential Equation (Initial Value Problems: Euler Method, Modified Euler Method & Boundary value problem: Finite Difference Method and Shooting Method, Convergence and Stability)	
	39	Numerical Solution of Partial Differentiation Equations	
14	40	Numerical solution of Ordinary Differential Equation (Initial Value Problems: Euler Method, Modified Euler Method & Boundary value problem: Finite Difference Method and Shooting Method, Convergence and Stability)	
	41	Numerical solution of Ordinary Differential Equation (Initial Value Problems: Euler Method, Modified Euler Method & Boundary value problem: Finite Difference Method and Shooting Method, Convergence and Stability)	
	42	Numerical Solution of Partial Differentiation Equations	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3, C4, C5
Final Exam	60%	CO 1	C2, C3
		CO 2	C4, C5
		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS

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

Spring SemesterL-2, T-I

COURSE INFORMATION

Course Code Course Title	: CE 261 : Fluid Mechanics	Lecture contact hours Credit hours	: 3.00 : 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

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

OBJECTIVE

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

COURSE CONTENT

Fluid properties; fluid statics; kinematics of fluid flows; fluid flow concepts and basic equations- continuity equation, Bernoulli's energy 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; major and minor losses in pipe flow; pipe flow problems-pipes in series and parallel, branching pipes, pipe networks

COURSE OUTCOMESAND SKILL MAPPING

No.	COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	**Understand** the basic properties of fluids, and apply Newton's Law of Viscosity in solving practical problems.	√											

2	**Understand** the significance of basic principles of fluid statics and application of hydrostatic law in determining forces on surfaces and hydraulic structures.	√											
3	**Understand** the basic principles of fluid kinematics and dynamics with specific emphasis on application of continuity equation, momentum equation etc.	√											
4	**Apply** the principles of Bernoulli's equation in measurement of discharge in pipes, and in other pipe flow problems.		√										
5	**Apply** fundamental concepts in designing pipes and analysis of pipe networks.			√									

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP (WP)	CA (EA)	KP (WK)	Assessment Methods
CO1	**Understand** the basic properties of fluids, and apply Newton's Law of Viscosity in solving practical problems.	1	C2	1	-	1, 2	Pop Quiz, Final Exam

CO2	**Understand** the significance of basic principles of fluid statics and application of hydrostatic law in determining forces on surfaces and hydraulic structures.	1	C2	1	-	1,2	Class Test, Mid-Term, Final Exam
CO3	**Understand** the basic principles of fluid kinematics and dynamics with specific emphasis on application of continuity equation, momentum equation etc.	1	C2	1	-	2,3	Mid-Term, Final Exam
CO4	**Apply** the principles of Bernoulli's equation in measurement of discharge in pipes, and in other pipe flow problems.	2	C3	3	-	5	Class Test, Mid-Term, Final Exam
CO5	**Apply** fundamental concepts in designing pipes and analysis of pipe networks.	3	C3	3	-	4	Class Test, Final Exam

WP= Washington Accord Complex Problem/ CP= Complex Problem; 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)	36 22

Preparation for tests and examination	
Assessment Continuous Assessment Final examination	 2 3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Introduction to Fluids and Fluid Mechanics	CT/ Assignment/ Final Exam
	2	Definition of a fluid, shear, strain rate and viscosity	
	3	Different type of fluid flow	
2	4	Fluid properties: density, pressure etc	
	5	Dynamic and Kinematic viscosity	
	6	Surface Tension	
3	7	Fluid Statics: Pascal's law	
	8	Variation of pressure, Manometers	
	9	Forces on plane surface – concept and problem	
4	10	Forces on inclined surface	CT/ Assignment/ Final Exam
	11	Forces on curved surface – concept	
	12	Forces on curved surface – problem	
5	13	Laminar and Turbulent Flows - Concept	
	14	Laminar and Turbulent Flows - Problem	
	15	Steady, Unsteady, Uniform, Non-uniform Flows	
6	16	1D, 2D and 3D Flows	Mid Term/ Assignment/ Final Exam
	17	Streamlines, Path lines and Stream tubes - Concept	
	18	Streamlines and Path lines - Problem	
7	19	Continuity Equation for 1D Steady Flow	
	20	Stream Function, Potential Function and Flow net	
	21	Various Types of Energy in Fluid Flow	
8	22	Bernoulli's Equation	

	23	Kinetic Energy Coefficient – Concept and Problem	
	24	Energy Equation for 1D Steady Flow	
9	25	Total Energy Line and Hydraulic Grade Line, Cavitations	
	26	Head and Power - Pump	
	27	Head and Power - Turbine	
10	28	Linear Momentum Equation	
	29	Momentum Coefficient	
	30	Force Exerted on Pressure Conduits	
11	31	Force Exerted on Stationary Vane	
	32	Force Exerted on Moving Vane	
	33	Reaction of a Jet	
12	34	Flow in pressure conduits	CT/ Assignment/ Final Exam
	35	General equation for fluid friction	
	36	Darcy-Weisbach and Hagen-Poisevielle Equation	
13	37	Major and minor losses in pipe flow	
	38	Pipes in series, expansions and contractions, loss coefficients	
	39	Pipes in parallel, equivalent lengths	
14	40	Branching pipes	
	41	Pipe networks, Hardy-Cross method	
	42	Pipe networks, multiple pipe systems	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4, CO5	C2, C3
Final Exam	60%	CO 2	C2
		CO 3	C2
		CO 4	C3
Total Marks	100%		

REFERENCE BOOKS
1. Fluid Mechanics with Engineering Application by Franzini 2. Mechanics of fluids by Merle Potter and David Wiggert (Schaum's Series) 3. Fluid Mechanics by Vernard and Street 4. Fluid Mechanics by Steeter and Wylie 5. Fluid Mechanics by Subrahmaniyam

Spring SemesterL-2, T-I

COURSE INFORMATION

Course Code	: CE 211	Lecture contact hours	: 3.00
Course Title	: Mechanics of Solids I	Credit hours	: 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This is a basic mechanics course for civil engineering students. In this course students will be introduced to basic solid mechanics including stress, strain, deformation, different loads, behavior of structures under loading.

OBJECTIVE

- Gain a fundamental understanding of the concepts of stress and strain by analysis of solids and structures. Study engineering properties of materials, force-deformation, and stress-strain relationship
- Learn fundamental principles of equilibrium, compatibility, and force-deformation relationship, and principle of superposition in linear solids and structures
- Analyse axial members, torsional members, and beams for axial force, shear, torsion and moment.
- Determine stress, strain, deformation of various structural components.

COURSE CONTENT

Concepts of stress and strain, generalized Hooke's law; constitutive relationships; plane stress & strain, stresses and deformation, resisting force, axial and transverse load; deformations due to tension, compression and temperature change; reactions, axial force, shear force and bending moments of beams; axial force, shear force and bending moment diagrams using method of section, summation approach and singularity function; flexural and shear stresses in beams; shear Centre; skew bending, closely coiled helical springs.

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	To **apply** the formal theory of solid mechanics to calculate forces, deflections, moments, stresses, and strains in a wide variety	√											

	of structural members subjected to tension, compression, torsion, bending, both individually and in combination.												
2	To **understand** the concepts of stress at a point, strain at a point, and the stress-strain relationships for linear, elastic, homogeneous, isotropic materials.	√											
3	To **determine** principal stresses and angles, maximum shearing stresses and angles, and the stresses acting on any arbitrary plane within a structural element.		√										

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	To **apply** the formal theory of solid mechanics to calculate forces, deflections, moments, stresses, and strains in a wide variety of structural members subjected to tension, compression, torsion, bending, both individually and in combination.	1	C3	1	-	1, 3	Class Test, Mid-term, Pop quiz, Final Exam

CO2	To **understand** the concepts of stress at a point, strain at a point, and the stress-strain relationships for linear, elastic, homogeneous, isotropic materials.	1	C2	2	-	1, 2	Class Test, Mid-term, Pop quiz, Final Exam
CO3	To **determine** principal stresses and angles, maximum shearing stresses and angles, and the stresses acting on any arbitrary plane within a structural element.	2	C3	1	-	3, 4	Class Test, Mid-term, Pop quiz, Final Exam
WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile							

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, Problem Based Learning (PBL)

TEACHING SCHEDULE			
Week	**Lecture**	**Topics**	**Assessments**
1	1	Course overview & Fundamental principles and methods of structural mechanics	CT/ Assignment/ Final Exam
	2	Concept of stress and strain	
	3	Equilibrium of deformed body	
2	4	Constitutive relationships	
	5	Plane stress & strain, stresses and deformation, resisting force, axial and transverse load	
	6	Supports, reactions and internal forces	
3	7	Plane stress & strain, stresses and deformation, resisting force, axial and transverse load	
	8	Mechanical properties of materials	
	9	Calculation of reactions, axial force, shear and bending moment	
4	10	Deformations due to tension, compression and temperature change	CT/ Assignment/ Final Exam
	11	Deformations due to tension, compression and temperature change	
	12	Calculation of reactions, axial force, shear and bending moment	
5	13	Deformations due to tension, compression and temperature change	
	14	Deformations due to tension, compression and temperature change	
	15	Calculation of reactions, axial force, shear and bending moment	
6	16	Deformations due to tension, compression and temperature change	Mid Term/ Assignment/ Final Exam
	17	Flexural stresses in beams	
	18	Axial force, Shear force and bending moment diagrams of beams: Section method	
7	19	Flexural stresses in beams	
	20	Flexural stresses in beams	
	21	Axial force, Shear force and bending moment diagrams of beams: Section method	

8	22	Flexural stresses in beams	
	23	Axial force, Shear force and bending moment diagrams of beams: Section method	
	24	Shear force and bending moment diagrams: Summation approach	
9	25	Flexural stresses in beams	
	26	Shear force and bending moment diagrams: Summation approach	
	27	Shear force and bending moment diagrams: Summation approach	
10	28	Flexural stresses in beams	
	29	Shear force and bending moment diagrams: Singularity function	
	30	Shear force and bending moment diagrams: Singularity function	
11	31	Flexural stresses in beams	
	32	Shear stresses in beams	
	33	Shear stresses in beams	
12	34	Skew bending	CT/ Assignment/ Final Exam
	35	Shear stresses in beams	
	36	Shear stresses in beams	
13	37	Skew bending	
	38	Shear flow, shear center and examples	
	39	Shear flow, shear center and examples	
14	40	Closely coiled helical springs	
	41	Closely coiled helical springs	
	42	Shear flow, shear center and examples	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3

Final Exam	60%	CO 1	C3
		CO 2	C2
		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS

1. Engineering Mechanics of Solids, Egor P. Popov, Prentice-Hall of India, 5th Edition.
2. Mechanics of Materials, Ferdinand P. Beer, E. Russell Johnston, Jonn T. DeWolf and David F. Mazurek, McGraw Hill, 6th Edition.
3. Mechanics of Materials, R C. Hibbeler, Pearson, 7th Edition
4. Mechanics of Materials, Ferdinand L Singer and Andrew Pytel, 4th Edition.
5. Strength of Materials, W A Nash, 4th Edition.

Spring SemesterL-2, T-II

COURSE INFORMATION			
Course Code Course Title	: CE 213 : Mechanics of Solids II	Lecture contact hours Credit hours	: 3.00 : 3.00

PRE-REQUISITE

CE 211

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

In this course students will be able to gain fundamental knowledge on stress, strain, deformation, behaviour of beams and columns subjected to various loading.

OBJECTIVE

By the end of this course students should be able

- To gain knowledge about the effect (state of stress) on beam due to combined loading and the transformation stresses and construction Mohr's circles of stress, subsequently understand the failure criteria by different theories of failure
- To understand Euler's buckling theory and its application in compressive members.
- To compute the deflection of beam by various methods.
- To develop the concept of strain energy for axial stress, flexural stress and shear stress.
- To understand the behaviour of cable under uniformly distributed load and concentrated load.

COURSE CONTENT (2021)

Stress transformation, Mohr's circle of stresses; beam deflection by direct integration method, moment area method; elastic strain energy and external work (Castigliano's Theorem), buckling of columns; concept of Euler's buckling of columns, elastic analysis of circular shafts, solid non-circular and thin-walled tubular members subjected to torsion, flexible chords, cable theorem; cable and cable supported structures; unsymmetric Bending.

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 stress and elastic strain energy under different loading (normal, shear, torsion etc).	√											

2	**Solve** the flexible cord, cable and cable supported structure	√											
3	**Determine** the deflection and rotation of flexural member.	√											
4	**Understand** the fundamental buckling phenomena of axially loaded members.		√										

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** the stress and elastic strain energy under different loading (normal, shear, torsion etc).	1	C2	1	-	3	Class Test/ Mid-term/ Pop quiz/ Final Exam
CO2	**Solve** the flexible cord, cable and cable supported structure.	1	C3	1	-	3, 4	Class Test/ Final Exam
CO3	**Determine** the deflection and rotation of flexural member.	1	C3	1	-	3, 4	Class Test/ Mid-term/ Pop quiz/ Final Exam
CO4	**Understand** the fundamental buckling phenomena of axially loaded members.	2	C2	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	18

Tutorial/ Assignments (4 hours/week x 5 weeks)	
Independent Learning Individual learning (1-hour lecture ≈1.0-hour learning) Preparation for tests and examination	33 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	Lecture	Topics	Assessments
1	1	Introduction and fundamentals of mechanics and mechanics of solids, Discussion on syllabus etc	Class Test, Mid-term, Pop quiz, Assignment,Final Exam
	2	Elastic strain energy and external work	
	3	Deflection of beam: Derivation of 2nd and 4th order differential equation of deflection of beam (direct integration method)	
2	4	Elastic strain energy and external work	
	5		
	6	Deflection of beam using direct integration method: Simply supported with point loading, discontinuous UDL, Concentrated moment	
3	7 -8	Beam deflection examples	
	9	Unsymmetric (Skew) Bending of Beam	
4	10	Unsymmetric (Skew) Bending of Beam	
	11	Deflection of beam using moment area method	
	12	Beam deflection examples	
5	13	Deflection of beam using moment area method	
	14		
	15	Unsymmetric (Skew) Bending of Beam	

6	16	Introduction to Buckling of column, related definitions and concepts. Derivation of Euler's Load for columns with pin ends. Euler Load for columns with different end restraints.	
	17	Flexible chords	
	18		
7	19	Euler Formula and buckling of columns	
	20		
	21	Cable theorem	
8	22	Euler Formula and buckling of columns	
	23		
	24	Cable and cable supported structures	
9	25	Basic concept of transformation of stress.	
	26	Transformation of stresses in 2D problems, Principal stresses in 2D problems, Maximum shear stresses in 2D problems	
	27	Cable theorem; cable and cable supported structures	
10	28	Examples of Transformation of stress	
	29	Elastic analysis of circular shafts subjected to torsion	
	30		
11	31	Mohr's circle of stresses	Class Test, Mid-term, Pop quiz, Assignment,Final Exam
	32	Elastic analysis of circular shafts subjected to torsion	
	33		
12	34	Mohr's circle of stresses	
	35	Solid non-circular subjected to torsion	
	36		
13	37	Mohr's circle of stresses	
	38	Thin-walled tubular members subjected to torsion	
	39		
14	40	Mohr's circle of stresses	
	41	Combination of composite-shape members subjected to torsion	
	42	Discussion	

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

REFERENCE BOOKS

1. Mechanics of Materials, Ferdinand P. Beer, E. Russell Johnston, Jonn T. DeWolf and David F. Mazurek, McGraw Hill, 6th Edition.
2. Engineering Mechanics of Solids, Egor P. Popov, Prentice-Hall of India, 5nd Edition.
3. Structural Analysis, R C. Hibbeler, Prentice Hall, 8th Edition.
4. Mechanics of Materials, R C. Hibbeler, Pearson, 8th Edition
5. Mechanics of Materials, Ferdinand L. Singer and Andrew Pytel, 4th Edition
6. Strength of Materials, W A Nash, 4th Edition

Spring semesterL-1, T-I

COURSE INFORMATION			
Course Code Course Title	: CE 100 : Civil Engineering Drawing	Lecture contact hours Credit hours	: 1.50 : 1.50

PRE-REQUISITE
None
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
It is a drawing course where students can lean drawing different linear and curved geometric figures e.g pentagon, hexagon, octagon, ellipse, parabola, hyperbola; solid geometry. Concept of isometric objects and orthographic views are discussed for clear understanding of students. In this course students will be able to learn how to draw the plan, elevation and sectional view of one storied building and bridges.
OBJECTIVE
• To get familiar with different drawing instruments and technical standards. • To develop a deep understanding of different geometric figures • To gain knowledge about drawing isometric and orthographic views. • To understand the concept of plan, elevation and sectional views of one storied building and bridge.
COURSE CONTENT
Lines and lettering; plane geometry: drawing of linear and curved geometric figures, e.g. pentagon, hexagon, octagon, ellipse, parabola, hyperbola; solid geometry: concept of isometric view and oblique view, theory of projections; drawing of isometric view of 3D objects such as cube, prism, pyramid, cone and cylinder; projections of cube, prism, cone, cylinder; developments of cube, pyramid, cone, cylinder; plan, elevations and sections of one storied buildings and bridges.

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	**Recognize** different drawing equipment and technical standards.	√											

2	**Understand** 2D and 3D views of simple objects.	√											
3	**Draw** different views of structural elements.	√											

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Recognize** different drawing equipment and technical standards.	1	C1	4	-	3	Class Assessment
CO2	**Understand** 2D and 3D views of simple objects.	1	C2	2	-	4	Quiz
CO3	**Draw** different views of structural elements.	1	C2	1	-	5	Group Project and Quiz

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (1 hours/week x 10 weeks)	10
Guided Learning Home Assessment (2 hour/week x 12 weeks)	24
Independent Learning Preparation for tests and examination	05
Assessment Quiz Viva Class Performance (1.5 hr/week X 12 weeks)	 02 01 18
Total	60

TEACHING METHODOLOGY

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

TEACHING SCHEDULE

Week	Topic	Assignments
1	Introduction	Repot, Quiz
	Use of Instruments	
	Lines and Dimensioning	
	Concepts of Isometric view, orthographic and 3D objects	
	Plane Geometry: Pentagon, Hexagon, Octagon etc.	
	Acquaintance with sheet layout and title block for each day submission	
2	Plane Geometry: Pentagon, Hexagon, Octagon etc.	
	Practice on Isometric Views from 3D view	
3	Practice on Isometric Views & Orthographic views of 3D Object	
4	Sectional views of 3D Object	
5	Visualization of 3D view from Isometric view	
6	**Mid Term Quiz**	
7	Introduction to different components of building	
	Understanding symbols on architectural drawings	
8	Plan view of one storied Residential building	
9	Elevation of view of one storied Residential building	
10	Sectional view of one storied Residential Building	
11	Understanding the information provided by the Structural and Architectural drawings	
12	Plan, Elevation and Sectional view of Culvert	
13	Review	
14	**Final Quiz**	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Quiz	60%	CO2, CO3	C1, C2

<table>
<tr><td rowspan="3">Assessment</td><td rowspan="3">20%</td><td>CO 1</td><td>C1</td></tr>
<tr><td>CO 2</td><td>C2</td></tr>
<tr><td>CO 3</td><td>C2</td></tr>
<tr><td>Viva and observation</td><td>20%</td><td>CO2, CO3</td><td>C1, C2</td></tr>
<tr><td>Total Marks</td><td>100%</td><td></td><td></td></tr>
<tr><td colspan="4">REFERENCE BOOKS</td></tr>
<tr><td colspan="4">1. Civil Engineering Drawing by - Gurcharan Singh & Subash Chandra
2. Prathomic Engineering Drawing by - Hamonto Kumar Bhottacharjo
3. Engineering Drawing by Basant Agrawal and C M Agrawal</td></tr>
</table>

Fall SemesterL-1, T-II

COURSE INFORMATION			
Course Code Course Title	: CE 102 : Computer Aided Drawing	Lecture contact hours Credit hours	: 3.00 : 1.50

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course will be useful for drawing of basic civil engineering components using AutoCAD software which will be helpful during project work in later semesters as well as in engineering practice.

OBJECTIVE

- To know about basics engineering drawing formats
- To gain knowledge about the basic functions of AutoCAD efficiently
- To take data and transform it into graphic drawings

COURSE CONTENT

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

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	Ability to **understand** the basic concept of AutoCAD software in civil engineering applications.					√							
2	Ability to **apply** the knowledge to draw detail architectural and structural drawing of a residential building.	√											

3.	Ability to **apply** the knowledge to draw sectional view, plan view and elevation of various structures.	√											

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** the basic concept of AutoCAD software in civil engineering applications.	5	C1	1	-	1	Class Assessment/ Quiz
CO2	Ability to **apply** the knowledge to draw detail architectural and structural drawing of a residential building.	1	C2	1,2	-	4,5	Class Assessment/ Quiz
CO3	Ability to **apply** the knowledge to draw sectional view, plan view and elevation of various structures.	1	C2	1,2	-	4,5	Class Assessment/ Quiz

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning	
Lecture (1.5 hours/week x 12 weeks)	18
Class assessment (1 hours/week X10 weeks)	10
Guided Learning	
Assignment Preparation (1.0 hours/week x 09 weeks)	09

Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for quiz	12 06
Assessment Quiz & Viva	 05
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Assessments
1	Introduction to computer usage	Class Assessment
	Introduction to CAD packages and computer aided drawing	
2	Drawing editing and dimensioning of simple objects	
3		
4		
5	Plan, elevations and sections of multi-storied buildings	
6		
7	Mid Term Quiz	Quiz
8	Reinforcement details of beams, slabs, stairs etc.	Class Assessment
9	Plan and section of septic tank	
10	Detailed drawings of roof trusses	
11	Plans, elevations and sections of culverts, bridges and other hydraulic structures	
12	Drawings of building services	
13	Viva	Viva
14	Final Quiz	Quiz

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Class Assessment, Viva	40%	CO1, CO2, CO3	C1, C2
Quiz	60%	CO1, CO2, CO3	C1, C2
Total Marks	100%		

REFERENCE BOOKS

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

Fall SemesterL-1, T-II

COURSE INFORMATION			
Course Code Course Title	: CE 104 : Practical Surveying	Lecture contact hours Credit hours	: 3 weeks : 1.50

PRE-REQUISITE
CE 103 (Surveying and Spatial Information Engineering)

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

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

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

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

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	Ability to **employ** appropriate survey instruments i.e. chain, plane table, level, theodolite, total station etc. in survey field works.	√											
2	Ability to **analyze** survey data in preparing longitudinal and transverse profiles of a		√										

	route and contour map of an area.												
3	Ability to **work** effectively as an individual and also as a member of a team in survey field works.									√			

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **employ** appropriate survey instruments i.e. chain, plane table, level, theodolite, total station etc. in survey field works.	1	C3	1,2	-	6	Daily Quiz/ Report/Final quiz/Viva
CO2	Ability to **analyze** survey data in preparing longitudinal and transverse profiles of a route and contour map of an area.	2	C4	2,3	-	5,6	Daily Quiz/ Report/Final quiz/Viva
CO3	Ability to **work** effectively as an individual and also as a member of a team in survey field works.	9	C3	1	-	6	Daily Quiz/ Report/Final quiz/Viva

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

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face to Face Learning	

Lecture (2 hours/week x 3 weeks) Field Work (15 hours/week x 3 weeks)	6 45
Guided Learning Report preparation (2 hours/week x 3 weeks)	6
Independent Learning Preparation for quiz & viva	2
Assessment Quiz & viva	1
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Linear and angular measurement techniques	Daily Quiz/ Report / Final Quiz/ Viva
	2	Route survey; Calculation of cut and fill volume	
	3	Traverse surveying	
	4	Trigonometry surveying	
	5	Tacheometry surveying	
2	6	Contouring	
	7	Curve Setting: Simple Circular Curve	
	8	Curve Setting: Combined Curve	
	9	Plane Table survey	
	10	Project surveying	
3	11	Hydrographic survey	
	12	Application of modern surveying equipment's like GPS, Total station, RTK GPS etc.	
	13		
	14	Final Quiz	
	15	Viva	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Daily Quiz & Report	50%	CO1, CO2, CO3	C3, C4
Final Quiz & Viva	50%	CO1, CO2, CO3	C3, C4
Total Marks	100%		

REFERENCE BOOKS

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

Spring SemesterL-2, T-I

COURSE INFORMATION			
Course Code Course Title	: CE 200 : Details of Constructions	Lecture contact hours Credit hours	: 3.00 : 1.50

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

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

OBJECTIVE

- To impart knowledge on the basics of different types of components of a building, design loads, framed structure and load bearing wall structure.
- To make the students efficient in practical field through site visits and technical sessions.

COURSE CONTENT

Types of building: components of a building, design loads, framed structure and load bearing wall structure; **foundations:** shallow and deep foundation, site exploration, bearing capacity of soil, standard penetration test; **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**, pointing, painting; distempering and white washing; cement concrete construction; **sound insulation:** acoustics; **thermal insulation**; **house plumbing:** water supply and wastewater drainage; **thunder arrestor**.

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 components of substructure and superstructure of a building, properties of construction materials, design	√											

	loads, framed structure and load bearing wall structure.												
2	**Understand** finishing and formwork of a building, heat and thermal insulation, and water supply and wastewater drainage system.	√											
3	**Recognize** different aspects of construction through field visit and team work.									√			

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** the components of substructure and superstructure of a building, properties of construction materials, design loads, framed structure and load bearing wall structure.	1	C1	1	-	1,3	Class Assessment/Report/ Quiz/Viva
CO2	**Understand** finishing and formwork of a building, heat and thermal insulation, and water supply and wastewater drainage system.	1	C1	1	-	1,3	Class Assessment/ Report/Quiz/Viva

CO3	**Recognize** different aspects of construction through field visit and team work.	9	C2	1	-	1,3	Presentation

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning	
Lecture (2 hours/week x 9 weeks)	18
Class assessment (1 hours/week X9 weeks)	9
Site visit (3 hours/week X2 weeks)	6
Guided Learning	
Assessment and Report Preparation (1.0 hours/week x 9 weeks)	9
Independent Learning	
Individual learning (1-hour lecture ≈ 1-hour learning)	9
Preparation for quiz	4
Assessment	
Quiz & Viva	4
Presentation	1
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	**Topics**	**Assessments**
1	Introduction to Building	Class Assessment/Report/Quiz/ Viva
2	Floors, Roofs and Stairs	
3	Introduction to Brick Masonry	
4	Plastering, Painting and Pointing	
5	Introduction to Lintels and Arches	
6	Site Visit	Presentation

7	Shoring; Underpinning; Scaffolding and Formwork	Class Assessment/Report/Quiz/ Viva
8	Mid Quiz	Quiz
9	Introduction to Deep and Shallow Foundations	Class Assessment/Report/Quiz/ Viva
10	Introduction to Project Planning and Construction	
11	Plumbing, Sound insulation, Thermal insulation, Thermal arrestor	
12	Site visit	Presentation
13	Final Quiz	Quiz
14	Presentation &Viva	Presentation

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Class Assessment/Report	35%	CO1, CO2	C1
Quiz & Viva	55%	CO1, CO2	C1
Presentation	10%	CO3	C2
Total Marks	100%		

REFERENCE BOOKS

1. Concrete and Formwork‖ by by T W Love
2. Building Construction‖ by – W.B. McKay (Vol. 1)
3. BDA Guide to Successful Brickwork‖ by the Brick Development Association.
4. Concrete Construction‖, by Ken Nolan
5. Building Construction‖ by – Sushil Kumar
6. Formwork for Concrete‖ by 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‖ by Peter Hemp
9. Building Construction‖ by – Dr. B.C. Punmia
10. Building Construction Engineering‖ by – Gurcharan Singh
11. Construction Drawings and Details for Interiors: Basic Skills, 2nd Edition‖ by Rosemary Kilmer and W. Otie Kilmer
12. Sound Insulation‖ by Carl Hopkins
13. Popular Mechanics Complete Home How-to‖ by Albert Jackson, David Day
14. PWD manual on house construction and plumbing

Spring SemesterL-2, T-I

COURSE INFORMATION

Course Code	: CE 262	Lecture contact hours	: 3.00
Course Title	: Fluid Mechanics Sessional	Credit hours	: 1.50

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

It is a sessional course where students can have a hand on experiment about the centre of pressure; proof of Bernoulli's theorem; flow through venturimeter; flow through orifice; coefficient of discharge; coefficient of resistance; flow over v-notch; flow over sharp-crested weir; fluid friction in pipe etc. which will be useful in their professional life.

OBJECTIVE

- To understand the basic principles of fluid mechanics,
- To apply the basic principles to solve hydraulic engineering problems,
- To apply the theoretical knowledge to carry out experimental investigations of fluid problems.

COURSE CONTENT

Centre of pressure; proof of Bernoulli's theorem; flow through venturimeter; flow through orifice; coefficient of discharge; coefficient of resistance; flow over v-notch; flow over sharp-crested weir; fluid friction in pipe; computer applications in solving pipe network problems.

COURSE OUTCOMESAND SKILL MAPPING

No.	COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	**Understand** the basic principles of fluid mechanics.	√											
2	**Apply** the basic principles of fluid mechanics to solve hydraulic engineering problems.		√										

3	**Apply** the theoretical knowledge to carry out experimental investigations of fluid problems.		√										

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP (WP)	CA (EA)	KP (WK)	Assessment Methods
CO1	**Understand** the basic principles of fluid mechanics.	1	C2	1	-	5	Lab Report + Quiz+ Viva
CO2	**Apply** the basic principles of fluid mechanics to solve hydraulic engineering problems.	2	C3	1	-	3, 6	Lab Report + Quiz + Viva
CO3	**Apply** the theoretical knowledge to carry out experimental investigations of fluid problems.	2	C3	3	-	3, 5	Lab Report + Quiz

WP= Washington Accord Complex Problem/ CP= Complex Problem; 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 10 weeks)	30
Guided Learning Report Writing (1 hour/week x 9 weeks)	01
Independent Learning Individual learning	10 08
Assessment	2

Quiz +Viva	
Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Experiments, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Assessments
1	Introduction	Lab Manual, Lecture notes, Reference texts etc.
2	Determination of Centre of Pressure	
3	Proof of Bernoulli's Equation	
4	Flow through an Orifice	
5	Flow Over a Sharp crested Rectangular Weir	
6	Mid Quiz	
7	Flow through a Venturi Meter	
8	Flow over a V-notch	
9	Fluid Friction in a Pipe	
10	Determination of Co-efficient of Resistance for Change in Cross Section of Pipe	
11	Determination of Co-efficient of Discharge using Orifice Discharge Apparatus	
12	Final Quiz	
13	Viva	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Continuous Assessment (Conduct Lab Test & Lab Report)	30%	CO1, CO2, CO3	C2, C3
Quiz & Viva	70%	CO 1	C2

		CO 2	C3
		CO 3	C3
Total Marks	100%		
REFERENCE BOOKS			
1. Fluid Mechanics Sessional Lab ManualOpen Channel Flow by V.T. Chow 2. Fluid Mechanics with Engineering Application by Franzini 3. Mechanics of fluids by Merle Potter and David Wiggert (Schaum's Series)			

Fall SemesterL-2, T-II

COURSE INFORMATION			
Course Code Course Title	: CE 208 : Quantity Surveying	Lecture contact hours Credit hours	: 3.00 : 1.50

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course is a hand on training for estimating quantity and cost for different components of various civil engineering infrastructures which will be helpful for the students in their professional field later on.

OBJECTIVE

- To gain knowledge on the basics of estimation of different types of structures.

COURSE CONTENT

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

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	**Summarize** the total amount of earthwork required for road construction.	√											
2	**Estimate** the total material and cost required for different components of a residential building.	√											

3	**Determine** the material required for different civil engineering structures such as culvert, septic tank, water reservoir and retaining wall.	√											
4	**Work** effectively as an individual and also as a member of a team in checking the market price and quality assessment of different construction materials.									√			

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Summarize** the total amount of earthwork required for road construction.	1	C2	1	-	4,6	Class Assessment/Report/Quiz
CO2	**Estimate** the total material and cost required for different components of a	1	C2	1	-	4,6	Class Assessment/Report/ Quiz

	residential building.						
CO3	**Determine** the material required for different civil engineering structures such as culvert, septic tank, water reservoir and retaining wall.	1	C2	1	-	4,6	Class Assessment/Report/ Quiz
CO4	**Work** effectively as an individual and also as a member of a team in checking the market price and quality assessment of different construction materials.	9	C3	1	-	6	Project (Market Survey)

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 11 weeks) Class assessment (1 hours/week X11 weeks)	22 11
Guided Learning Assessment Preparation (1.0 hours/week x 11 weeks)	11
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning)	08 04

Preparation for quiz	
Assessment Quiz Presentation	 03 01
Total	60

TEACHING METHODOLOGY

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

TEACHING SCHEDULE

Week	Topics	Assessments
1	Earthwork excavation for roadway, earthwork computation from spot levels	Class Assessment/Report
2	Estimation for residential building: One Storied residential building. Analysis of rates, specifications, costing of residential building	
3		
4		
5		
6	Mid Quiz	Quiz
7	Estimation of RCC for footing, column	Class Assessment/Report
8	Estimation of RCC for beam	
9	Estimation of RCC for slab	
10	Estimation of septic tank and underground water reservoir	
11	Estimation of retaining wall	
12	Estimation of slab culvert	

13	Project presentation	Presentation
14	Final Quiz	Quiz

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Class Assessment/ Report	50%	CO1, CO2, CO3	C2
Presentation	10%	CO4	C3
Quiz	40%	CO1, CO2, CO3	C2
Total Marks	100%		

REFERENCE BOOKS

1. Estimating by – Abul Faraz Khan
2. Quantity Surveying: A Practical Guide for the Contractor's QS by Donald Towey
3. Estimating & Costing in Civil Engineering by – Dutta

Spring SemesterL-2, T-I

COURSE INFORMATION			
Course Code Course Title	: CE 210 : GIS and Remote Sensing	Lecture contact hours Credit hours	: 3.00 : 1.50
PRE-REQUISITE			
CE 103 (Surveying and Spatial Information Engineering)			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This is a hand on training course for GIS and remote sensing. In this course students will be introduced to basic functions and analysis of GIS. Students will be also practice using GIS software for conducting spatial analysis.			
OBJECTIVE			
• To understand basic functions of GIS • To understand common formats of GIS data like shapefiles, raster, and geodatabases. • To produce maps for basic GIS analysis • To utilize GIS software for conducting spatial analysis			
COURSE CONTENT			
GIS: basic concepts, location & spatial data, GIS data source (vector & raster data), Map Projection System; use and application of GIS in civil engineering aspects; Features of Arc GIS, Hands-on exercises using Arc GIS, Google Earth and related software. **Remote Sensing:** Introduction to satellite images, Classification of Indices, Digitization of satellite images.			

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	**Define** the fundamental concepts and practices of Geographic Information Systems (GIS).	√											
2	**Apply** basic graphic and data visualization	√											

	concepts such as colour theory, symbolization.												
3	**Define** the fundamental concepts and practices of Geographic Information Systems (GIS).	√											
4	**Apply** basic GIS and remote sensing analysis tools to address geospatial problems and/or research questions.					√							

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Define** the fundamental concepts and practices of Geographic Information Systems (GIS).	1	C1	1	-	1	Class Assessment/ Quiz
CO2	**Apply** basic graphic and data visualization concepts such as colour theory, symbolization.	1	C3	2,3	-	4,5	Class Assessment/ Quiz
CO3	**Define** the fundamental concepts and practices of Geographic Information Systems (GIS).	1	C2	1	-	1	Class Assessment/ Quiz
CO4	**Apply** basic GIS and remote sensing analysis tools to address geospatial problems and/or research questions.	5	C3	2,3	-	4,5	Class Assessment/ Quiz

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

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (2 hours/week x 11 weeks) Class assessment (1 hours/week X10 weeks)	 22 10
Guided Learning Assessment Preparation (1.0 hours/week x 10 weeks)	10
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for quiz	11 04
Assessment Quiz	 03
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	**Topics**	**Assessments**
1	Basic concepts of GIS and spatial data; use and application of GIS in civil engineering aspects	Class Assessment
2	Introduction to GIS; Introduction to ArcGIS desktop software	
3	Map Design	
4	GIS Output	
5	Table Operation	
6	Geoprocessing	
7	Mid Quiz	Quiz

8	Introduction to Map, Map Projections, and Coordinate Systems; Georeferencing	Class Assessment
9	Digitizing and Editing	
10	Spatial Analysis	
11	Introduction to satellite images	
12	Classification of Indices	
13	Digitization of satellite images	
14	Final Quiz	Quiz

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Class Assessment	50%	CO1, CO2, CO3, CO4	C1, C2, C3
Quiz	50%	CO1, CO2, CO3, CO4	C1, C2, C3
Total Marks	100%		

REFERENCE BOOKS

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

Spring SemesterL-2, T-I

COURSE INFORMATION			
Course Code Course Title	: CE 212 : Structural Mechanics and Materials Sessional	Lecture contact hours Credit hours	: 1.50 : 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This is a material based sessional course for civil engineering students. In this course students will be learnt how to determine different properties of materials specially for civil engineering related materials like cement, aggregate, brick and steel reinforcement. Besides, students will be able to know and interpret different standards for materials testing.

OBJECTIVE

- To determine different engineering properties of materials like cement, aggregate, brick, metal etc.
- To learn the mix design of mortar and concrete
- To determine different mechanical properties of mortar and concrete.
- To determine different mechanical properties structural members like column, beam, etc.
- To know and interpret different standards for materials testing.

COURSE CONTENT

Normal consistency, initial setting time, and fineness test of cement, compressive strengths of cement mortar; gradation, specific gravity, absorption capacity and unit weight of fine and coarse aggregates; design and testing of a concrete mix and testing of bricks for compressive strength. Tension, direct shear and impact tests of mild steel specimen; slender column test; static bending test; hardness test of metals; helical spring test.

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	Ability to **determine** the engineering properties of cement, aggregate, brick and metal.	√											

2	Ability to **design** a mix design of mortar and concrete.			√									
3	Ability to **determine** different mechanical properties of mortar and concrete.	√											
4	Ability to **determine** different mechanical properties structural members like column, beam, etc.	√											

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **determine** the engineering properties of cement, aggregate, brick and metal.	1	C1	1	-	1, 3	Report, Pop quiz, Final Quiz, VIVA
CO2	Ability to **design** a mix design of mortar and concrete.	3	C6	3	-	3, 5	Report, Pop quiz, Final Quiz, VIVA
CO3	Ability to **determine** different mechanical properties of mortar and concrete.	1	C1	1	-	1, 3	Report, Pop quiz, Final Quiz, VIVA
CO4	Ability to **determine** different mechanical properties structural members like column, beam, etc.	1	C1	1	-	1, 3	Report, Pop quiz, Final Quiz, VIVA

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

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (2 hours/week x 13 weeks)	26
Guided Learning Tutorial/ Assignments (0.5 hours/week x 14 weeks)	7
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	 14 10
Assessment Quiz + Viva	3
Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Assessments
1	Normal consistency, Initial and Final setting time	Report + Quiz + VIVA
2	Tension tests of mild steel specimen	
3	Compressive strengths of cement mortar	
4	Slender column test	
5	Specific Gravity and Absorption of Coarse and Fine Aggregate	
6	Static bending test	
7	Unit Weight and Voids in Coarse and Fine Aggregate	
8	Hardness test of metals	
9	Sieve analysis of Coarse and Fine Aggregate	
10	Impact tests of mild steel specimen	
11	Design and Testing of a Concrete Mix	
12	Helical Spring	

13	Testing of Bricks for Compressive Strength	
14	Quiz + VIVA	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Lab Report)	40%	CO 1	C1
		CO 2	C6
		CO 3	C1
		CO4	C1
Final Exam Quiz 1 & Quiz 2	50%	CO 1	C1
		CO 2	C6
		CO 3	C1
		CO4	C1
VIVA	10%	CO 1	C1
		CO 2	C6
		CO 3	C1
		CO4	C1
Total Marks	100%		

REFERENCE BOOKS

1. Engineering Mechanics of Solids by – Popov
2. Theory and Problems of Strength of Materials by -William A Nash
3. Laboratory Manual
4. ASTM/BSTI Standards

5.7 Civil Engineering Practices

Fall semester L-3, T-II

COURSE INFORMATION			
Course Code Course Title	: CE 300 : Civil Engineering Students' Internship Programme (CESIP)	Lecture contact hours Credit hours	: 3 Weeks : 1.5
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
In this course students will learn the details of construction works and different testing procedure related to civil engineering works. They can corelate their theoretical knowledge with practical application.			
OBJECTIVE			
• To observe the details of construction works /testing procedure • To identify any technical deviation in construction project from theoretical knowledge • To gain knowledge about construction management • To perform verbal presentation on the practical knowledge			
COURSE CONTENT			
3 weeks of internship in a civil engineering related job at an organization/firm 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
1	Ability to **gain** practical professional experience in Civil Engineering.	√											

2	Ability to **work** effectively as an individual and also as a member of a team during industrial attachment.									√			
3	Ability to **develop** an appreciation of the breadth of Civil Engineering which helps to gain life-long learning capability.												√
4	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 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 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

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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

Week	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	50%	CO1	C2
		CO2	C3

(Report)		CO3	C3
		CO4	C2
Presentation & VIVA	50%	CO1	C2
		CO2	C3
		CO3	C3
		CO4	C2
Total Marks	100%		

5.8 Structural Engineering

Spring semester L-3, T-I

Theoretical (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 311 : Structural Analysis and Design I	Lecture contact hours Credit hours	: 4.00 : 4.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

It is the first course on structural analysis. In this course, students will learn how to analysis various structural components subjected to both static and moving loads. The analysis techniques learnt in this course will be useful in later courses where students will learn how to design different structural components.

OBJECTIVE

- To analyze statically determinate structures such as simple beams, cantilever beams, three hinged arches or frames and trusses.
- To analyze statically indeterminate structures using simplified methods
- To analyse the application of lateral load on structures using Bangladesh National Building Codes.
- To analyze moving load on various types of structures

COURSE CONTENT

Stability and determinacy of structures; Analysis of statically determinate frames, gable frames, trusses and arches; Influence lines for beams, floor beams, determinate frames and trusses; Moving loads on beams, frames and trusses; Absolute Maximum moments for Wheel Loads; Analysis of suspension bridges. Wind and earthquake loads, code provisions as per BNBC. Approximate analysis of statically indeterminate structures: Mill bents, braced trusses; multi storied building frames analysis under vertical load and lateral load (Portal and cantilever method); Deflection of trusses and frames by virtual work method;

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	Ability to **analyze** statically determinate structures.		√										
2	Ability to **analyze** the effect of moving loads on statically determinate structures		√										
3	Ability to **solve** statically indeterminate structures using approximate methods.		√										
4.	Ability to **calculate** lateral loads of a multi-storied building.		√										

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **analyze** statically determinate structures.	2	C4	2	-	4	Class Test, Mid-term, Final Exam
CO2	Ability to **analyze** the effect of moving loads on statically determinate structures	2	C4	2	-	4	Class Test, Mid-term, Final Exam
CO3	Ability to **solve** statically indeterminate structures using approximate methods	2	C4	2	-	4	Class Test, Mid-term, Final Exam

CO4	Ability to **calculate** lateral loads of a multi-storied building.	2	C4	2	-	4	Class Test, Mid-term, Final Exam

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (4 hours/week x 14 weeks)	56
Guided Learning Tutorial/ Assignments (3 hours/week x 5 weeks)	20
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	36 42
Assessment Continuous Assessment Final examination	3 3
Total	160

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	**Lecture**	**Topics**	**Assessments**
1	1	Earthquake load calculation as per BNBC-1993	CT/ Assignment/ Final Exam
	2	Earthquake load calculation as per BNBC-1993	
2	3	Earthquake load calculation as per BNBC-2014	
	4	Earthquake load calculation as per BNBC-2014	
3	5	Wind load calculation as per BNBC-1993	
	6	Wind load calculation as per BNBC-1993	
4	7	Wind load calculation as per BNBC-2014	CT/ Assignment/ Final Exam
	8	Wind load calculation as per BNBC-2014	
5	9	Approximate analysis of statically indeterminate truss	

Week	Lecture	Topics	Assessment
	10	Approximate analysis of statically indeterminate truss	
6	11	Approximate analysis of statically indeterminate portal frame subjected to vertical load.	Mid Term/ Assignment
	12	Approximate analysis of statically indeterminate portal frame subjected to vertical load.	
7	13	Approximate analysis of statically indeterminate portal frame subjected to lateral load using portal method	
	14	Approximate analysis of statically indeterminate portal frame subjected to lateral load using portal method	
8	15	Approximate analysis of statically indeterminate portal frame using cantilever method	
	16	Approximate analysis of statically indeterminate portal frame using cantilever method	
9	17	Approximate analysis of tower truss	
	18	Approximate analysis of tower truss	
10	19	Approximate analysis of tower truss	
	20	Approximate analysis of tower truss	
11	21	Principle of work and energy. Principle of virtual work	
	22	Analysis and deflection calculation of truss using method of virtual work	
12	23	Introduction to Castigliano's theorem	CT/ Assignment/ Final Exam
	24	Analysis and deflection calculation of truss using Castigliano's theorem	
13	25	Analysis and deflection calculation of beam using method of virtual work	
	26	Analysis and deflection calculation of frame using method of virtual work	
14	27	Analysis and deflection calculation of beam using Castigliano's theorem	
	28	Analysis and deflection calculation of frame using Castigliano's theorem	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment	40%	CO1, CO2, CO3, CO4	C4

(Class assignments/ CT/ Mid Term/ Active Class Participation)			
Final Exam	60%	CO 1	C4
		CO 2	C4
		CO 3	C4
		CO 4	C4
Total Marks	100%		

REFERENCE BOOKS

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

Spring semester L-3, T-I

Theoretical (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 315 : Design of Concrete Structures I	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
In this course students will learn to design different types of reinforced concrete slab and beam under flexural and shear loading and to develop a strong foundation and design concepts of reinforced concrete building which will be beneficial for their future development and professionalism.			
OBJECTIVE			
• To gain knowledge on the basics of reinforced concrete structure. • To be able to design beam, slab and web reinforcement for beam. • To become aware of the proper safety and serviceability of reinforced concrete structures.			
COURSE CONTENT (2021)			
Fundamental behaviour of reinforced concrete and loads on structure; introduction to strength and serviceability design and alternative 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 of reinforcement and its detailing. Introduction to floor systems; structural forms, Design of one-way slabs; design of two-way edge supported slabs: using strip and alternate methods			

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** fundamental design concepts of reinforced concrete.	√											

2	**Analyze** the capacity of structural member against applied load considering the given material property.		√										
3	**Design** different structural elements ie slabs, beams for flexure and shear using code provisions.			√									

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** fundamental design concepts of reinforced concrete.	1	C2	1	-	3,4	Class Test/ Mid-term/ Final Exam
CO2	**Analyze** the capacity of structural member against applied load considering the given material property.	2	C4	1	-	4	Class Test/ Mid-term/ Final Exam
CO3	**Design** different structural elements ie slabs, beams for flexure and shear using code provisions.	3	C3	1	-	5	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)	18

Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	33 22
Assessment Continuous Assessment Final examination	2 3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Introduction to Concrete, Reinforced Concrete and prestressed concrete, load according to BNBC	Class Test, Mid-term, Pop quiz, Final Exam
	2	Introduction to strength design and alternate design methods;	
	3	Safety provision of ACI Code, serviceability.	
2	4	Fundamental assumption of RC concrete, Behavior under axial load	
	5	Design example.	
	6	Materials, properties under compression, shrinkage, temperature, stress strain curve, relaxation etc.	
3	7	Flexural analysis and design of beam, bending of homogenous beam	
	8	RC concrete beam behavior.	
	9	Design example.	
4	10	Design of tension reinforced rectangular beam, ACI Code Provisions	
	11	Under-reinforced, over-reinforced beam, minimum reinforcement ratio.	
	12	Design of Singly reinforced beam	
5	13	Design example of singly reinforced beam	

	14	Design aid, Practical consideration in the design of beam,	
	15	Rectangular beam with tension and compression.	
6	16	Doubly Reinforced beam analysis	
	17	Design example of doubly reinforced beam.	
	18	Design example of doubly reinforced beam.	
7	19	T-beam analysis	
	20	Effective flange width, strength analysis.	
	21	T-beam design example	
8	22	T-beam design example	
	23	Shear and diagonal tension in beams. Diagonal tension in homogenous elastic beams	
	24	Reinforced concrete beam without shear reinforcement	
9	25	ACI code provision for shear design	
	26	Design Example.	
	27	Design of web reinforcement.	
10	28	Design problems.	
	29	Analysis and design of slab, design of one-way slab.	
	30	Temperature shrinkage reinforcement, Design example of one-way slab.	
11	31	Design example and detailing of one-way slab.	
	32	Behavior of two-way edge supported slab; column supported slab.	
	33	Design procedure of slab using various methods.	
12	34	Introduction to moment coefficient method	
	35	Design example of two-way slab using moment coefficient method.	
	36	Design example of two-way slab using moment coefficient method.	
13	37	Design example of two-way slab using moment coefficient method.	
	38	Design and reinforcement detailing of two-way slab.	

	39	Bond and anchorage and Development length, fundamental of flexural bond.	
14	40	Bond strength and development length, anchorage requirement for web RCC.	
	41	Bar cut-off and bent point of beams, Bar splices.	
	42	Design example of development length.	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3, C4
Final Exam	60%	CO 1	C2
		CO 2	C4
		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS

1. Reinforced Concrete: Mechanics and Design (6th Edi) by James Wight and James MacGregor
2. “Design of Concrete Structures” by – Nilson (12th Edition)
3. “Design of Concrete Structures” by – Nilson, David & Dolan (14th Edition)
4. Structural Design Guide to the ACI Building Code (3rd Edition) - Rice, Hoffman, Gustafson, Gouwens
5. Bangladesh National Building Code (Latest Version)

Fall semester L-3, T-II

Theoretical (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 317 : Design of Concrete Structures II	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
CE 315			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
In this course students will learn to design various components of reinforced concrete building, such as slab with/without beams, short column, slender column, footing, pile caps, retaining wall, shear wall, etc and to develop a strong foundation and concepts of seismic resistant building and pre-stressed concrete which will be beneficial for their future development and professionalism.			
OBJECTIVE			
• To develop a strong foundation on reinforced concrete structure maintaining proper safety and serviceability requirement. • To be able to design various components of reinforced concrete structure, specially focusing on slab with/without beams, short column, slender column, footing, pile caps, retaining wall, shear wall etc. • To understand the basic concepts of pre-stressed concrete. • To be able to analyse pre-stressed concrete beam			
COURSE CONTENT (2021)			
Design of columns under uniaxial and biaxial loading, introduction to slender column; structural design of footings, pile caps; retaining wall, seismic detailing; shear wall subjected to axial load and flexure; Design of column supported slabs; Prestressed Concrete: concepts of prestressing; materials; anchorage systems; analysis and preliminary design of prestressed beam.			

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	Ability to **understand** basic concepts of pre-stressed concrete.	√											

2	Ability to **design** structural components of a reinforced concrete building.			√									
3	Ability to **apply** considerations and criteria of seismic resistant building.	√											

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** basic concepts of pre-stressed concrete.	1	C2	1	-	3, 4	Pop quiz, Final Exam
CO2	Ability to **design** structural components of a reinforced concrete building.	3	C3	1	-	5	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **apply** considerations and criteria of seismic resistant building.	1	C3	1	-	4	Class Test, 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)	36 22

Preparation for tests and examination	
Assessment Continuous Assessment Final examination	 2 3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Course overview & Fundamental behavior of reinforced concrete column	Class Test, Mid-term, Pop quiz, Assignment, Final Exam
	2	Introduction to axial compression	
	3	Structural design of footings	
2	4	Compression plus bending of rectangular columns & Interaction diagrams	
	5		
	6	Structural design of footings	
3	7	Compression plus bending of rectangular columns & Interaction diagrams and Balanced failure	
	8	Structural design of footings	
	9	Structural design of pile caps	
4	10	Compression plus bending of rectangular columns & Interaction diagrams and Balanced failure	
	11	Structural design of pile caps	
	12	Structural design of pile caps	
5	13	ACI code provisions for column design and Design aids	
	14	Biaxial bending	
	15	Design of RCC shear wall.	
6	16	Biaxial bending	
	17	Design of RCC shear wall.	
	18	Design of RCC shear wall.	
7	19	Slender columns	
	20		
	21	Seismic detailing.	
8	22	Slender columns	
	23		
	24	Seismic detailing.	
9	25	Introduction to floor systems, Design of column supported slabs	

	26	Introduction to Pre-stressed Concrete	
	27	1st Concept of pre-stressing	
10	28	Design of column supported slabs	
	29	2nd and 3rd Concept of pre-stressing	
	30	Type and Classification of Pre-stressing	
11	31	Design of column supported slabs	
	32	Stages of Loading in Pre-stressed Concrete Beam	
	33	Pre-stressed Concrete materials and anchorage systems.	
12	34	Design of column supported slabs	
	35	Pre-stressed Concrete materials and anchorage systems.	
	36	Pre-stressed Concrete materials and anchorage systems.	
13	37	Design of column supported slabs	
	38	Losses of Pre-stressed Concrete	
	39	Analysis of pre-stressed concrete beam.	
14	40	Design of column supported slabs	
	41	Preliminary Design of pre-stressed concrete beam.	
	42	Preliminary Design of pre-stressed concrete beam.	

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	C2
		CO 2	C3
		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS

1. Design of Concrete Structures, Arthur H. Nilson, David Darwin and Charles W. Dolan, McGraw Hill, 15th Edition.
2. Reinforced Concrete: Mechanics and Design, James Wight and James MacGregor, Pearson, 6th Edition.
3. Reinforced Concrete: A Fundamental Approach, Edward G. Nawy, Pearson, 5th Edition.
4. Design of Reinforced Concrete, Jack C. McCormac and James K. Nelson, John Wiley & Sons, Inc., 7th Edition.
5. Fundamentals of Reinforced Concrete by – Ferguson & Philip
6. Bangladesh National Building Code (BNBC)
7. Design of Prestressed Concrete Structure by – T.Y. Lin, Ned H. Burns (3rd Edition)
8. Prestressed Concrete Structures by Michael P Collins

Spring semester L-4, T-I

Theoretical (Core)

COURSE INFORMATION

Course Code Course Title	: CE 413 : Design of Steel Structures	Lecture contact hours Credit hours	: 3.00 : 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

It is a design course for steel structures, especially to learn how to design and analyze the tension and compression members, bolt and weld connections. In this course, students will also be introduced with the concept of buckling, flexural and shear strength, non-sway frame etc. which will be useful in various projects in the later semesters and in their professional life.

OBJECTIVE

- To develop a deep understanding of behavioural principles of structural steel.
- To gain familiarity with limit state design philosophy.
- To determine critical loading patterns for design.
- To design steel components to resist applied loads and satisfy performance objectives.
- To gain detailed knowledge pertaining to the requirements of American Institute of Steel Construction (ANSI/AISC) Standards.

COURSE CONTENT

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

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	Ability to **design** various steel structural components including tension member, compression member, flexural member.		√										

2	Ability to **analyze** and **design** beam column connections of steel structures.		√	√									
3	Ability to **produce** steel structural drawings as per code with proper detailing as a teamwork.									√			

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **design** various steel structural components including tension member, compression member, flexural member.	2	C3/C4	1, 2	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **analyze** and **design** beam column connections of steel structures.	2, 3	C4	2	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **produce** steel structural drawings as per code with proper detailing as a teamwork.	9	C2/C3	5	-	3, 4	Assignment, Pop quiz

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

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	Lecture	Topics	Assessments
1	1	Behaviour of structural steel	CT/ Assignment/ Final Exam
	2	Residual stress	
	3	Compression members	
2	4	Compression members	
	5	Local buckling	
	6	Compression members	
3	7	Compression members	
	8	Tension members	
	9	Lateral torsional buckling	
4	10	Lateral torsional buckling	CT/ Assignment/ Final Exam
	11	Tension members	
	12	Lateral torsional buckling	
5	13	Design of beam-columns	
	14	Tension members	
	15	Design of beam-columns	
6	16	Design of beam-columns	Mid Term/ Assignment/ Final Exam
	17	Tension members	
	18	Design of beam-columns	
7	19	Bolted and welded connections	
	20	Flexural members	

	21	Bolted and welded connections	
8	22	Flexural members	
	23	Bolted and welded connections	
	24	Flexural members	
9	25	Flexural members	
	26	Bolted and welded connections	
	27	Connection design	
10	28	Connection design	
	29	Bolted and welded connections	
	30	Connection design	
11	31	Connection design	
	32	Bolted and welded connections	
	33	Moment connections	
12	34	Moment connections	CT/ Assignment/ Final Exam
	35	Detailing of steel structures, introduction to steel-concrete composite structures	
	36	Moment connections	
13	37	Column bases	
	38	Introduction to steel-concrete composite structures	
	39	Column bases	
14	40	Column bases	
	41	Advantages of composite construction	
	42	Various types of steel concrete composite columns	

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, CO 2, CO 3	C3, C4, C4, C2, C3
Total Marks	100 %	-	-

REFERENCE BOOKS
1. Steel Structures: Design and Behavior by Salmon, Johnson and Malhas (5^{th}Edition) 2. Design of Steel Structures by – Gaylord, Gaylord 3. Limit States Design in Structural Steel by G L Kulak and G Y Grondin 4. AISC Manuals for Steel Constructions (13th Edition-2005)

Spring semester L-4, T-I

Theoretical (Core)

COURSE INFORMATION

Course Code	: CE 411	Lecture contact hours	: 3.00
Course Title	: Structural Analysis and Design II	Credit hours	: 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

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

- To gain knowledge on analysing the statically indeterminate beams and frames by moment distribution, consistent deformation/ flexibility and stiffness methods.
- To attain a workable knowledge on generating algorithms by using direct stiffness method using computer.
- To gain knowledge on developing influence lines of statically indeterminate beams and frames.

COURSE CONTENT

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

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	Ability to **analyze** statically indeterminate structures.		√										
2	Ability to **develop** algorithms by using direct stiffness method.		√										

3	Ability to **solve** influence lines for statically indeterminate structures.		√										

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **analyse** statically indeterminate structures.	2	C4	1	-	1, 2	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **develop** algorithms by using direct stiffness method.	2	C6	2, 3	-	2, 3	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **solve** influence lines for statically indeterminate structures.	2	C4	2, 3	-	2, 3	Class Test, Mid-term, Final Exam

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

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	Lecture	Topics	Assessments
1	1	Course overview & Fundamental principles and methods of structural analysis	CT/ Assignment/ Final Exam
	2	Moment distribution method - Beam	
	3	Stiffness methods	
2	4	Moment distribution method - Beam	
	5	Stiffness methods	
	6	Stiffness methods	
3	7	Moment distribution method - Beam	
	8	Stiffness methods	
	9	Stiffness methods	
4	10	Moment distribution method - Frame	CT/ Assignment/ Final Exam
	11	Stiffness methods	
	12	Stiffness methods	
5	13	Moment distribution method - Frame	
	14	Stiffness methods	
	15	Direct stiffness methods	
6	16	Moment distribution method - Frame	Mid Term/ Assignment// Final Exam
	17	Direct stiffness methods	
	18	Direct stiffness methods	
7	19	Moment distribution method - Frame	
	20	Direct stiffness methods	
	21	Flexibility method	

8	22	Moment distribution method - Frame	
	23	Moment distribution method - Frame	
	24	Flexibility method	
9	25	Influence lines of statically indeterminate beams	
	26	Influence lines of statically indeterminate beams	
	27	Flexibility method	
10	28	Influence lines of statically indeterminate beams	
	29	Influence lines of statically indeterminate beams	
	30	Flexibility method	
11	31	Influence lines of statically indeterminate frames	
	32	Influence lines of statically indeterminate beams	
	33	Flexibility method	
12	34	Influence lines of statically indeterminate frames	CT/ Assignment// Final Exam
	35	Influence lines of statically indeterminate beams	
	36	Writing computer programs for framed structures	
13	37	Influence lines of statically indeterminate frames	
	38	Influence lines of statically indeterminate beams	
	39	Writing computer programs for framed structures	
14	40	Influence lines of statically indeterminate frames	
	41	Influence lines of statically indeterminate beams	
	42	Writing computer programs for framed structures	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C4, C6
Final Exam	60%	CO 1	C4
		CO 2	C6
		CO 3	C4
Total Marks	100%		

REFERENCE BOOKS

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

Fall semester L-3, T-II

Sessional (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 316 : Concrete Structures Design Sessional I	Lecture contact hours Credit hours	: 3.00 : 1.50
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This is the class room design sessional where students will be guided to design and prepare detailing of different components of a low-rise masonry structure, slab bridge and balanced cantilever bridge.			
OBJECTIVE			
• To design a reinforced concrete low-rise building. • To design slab bridge and balanced cantilever bridge in real time project. • To identify, formulate and solve real time RCC structures.			
COURSE CONTENT (2021)			
Design and detailing of a low-rise masonry building; Design and detailing of a slab bridge; Design and detailing of a balanced cantilever bridge.			

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 basic concepts of limit state design	√											
2	**Design** different elements of a low-rise masonry building.			√									
3	**Design** of various structural components of a slab bridge and a balanced cantilever bridge.			√									

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** the basic concepts of limit state design	1	C2	1		4, 5	Mid quiz, Final quiz, Assignment, Viva
CO2	**Design** different elements of a low-rise masonry building.	3	C3	1, 5		5	
CO3	**Design** of various structural components of a slab bridge and a balanced cantilever bridge.	3	C3	1		5	
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 12 weeks)	36
Guided Learning Report Writing (1 hours/week x 12 weeks)	12
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	 3 3
Assessment Continuous Assessment Quiz	 3 3
Total	60

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Assessments
1.	Introduction to the design of a masonry building following BNBC guidelines and design of slab of a low-rise masonry building.	Mid quiz, Final quiz, Assignment, Viva
2.	Design of beam	
3.	Design of stair	
4.	Design of sunshade and lintel	
5.	Design of foundation	
6.	**Mid Quiz**	
7.	Introduction on bridge design and Design of Slab Bridge with detailing	
8.	Introduction to the design of a balanced cantilever bridge. Design of deck slab and railing of a balanced cantilever bridge.	
9.	Analysis of Interior Girder for dead loads and live loads	
10.	Analysis of Interior Girder for dead loads and live loads	
11.	Design of Interior girder	
12.	Design of Exterior girder and diaphragm	
13.	Design of articulation.	
14.	**Viva/ Oral Presentation/Final Quiz**	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Continuous Assessment (Class performance/assignments/ Report writing/ Presentation/Viva)	50%	CO1, CO2, CO3	C2, C3
Quiz	50%	CO 1	C2
		CO 2	C3
		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS

1. Design of Concrete Structures by Nilson (10th, 12th and 14th Edition)
2. Bangladesh National Building Code (BNBC) - 2012
3. AASHTO LRFD Bridge: Design Specifications 2012

Spring semester L-4, T-I

Sessional (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 410 : Concrete Structures Design Sessional II	Lecture contact hours Credit hours	: 3.0 : 1.5

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
It is a design course for reinforced concrete structures, especially to learn how to analyze and design different components of RC building by hand and apply modern tools like computer software to accelerate the analysis and design process. Students will understand the general structural behaviour and design concepts of RC building structures.

OBJECTIVE

- To develop a deep understanding of behavioural principles of reinforced concrete structure.
- To analysis and design of different components of RC buildings under wind and seismic application.
- To apply Finite Element tools to check and accelerate the analysis and design of building structures.

COURSE CONTENT
Analysis and design of RC moment frame buildings for wind and seismic application; multi-storeyed RC buildings with shear wall and mat foundation for wind and seismic application; Analysis and Design using Finite Element Software like ETABS and SAP2000.

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	Ability to **analyze** an RC moment frame building for lateral loads.		√										
2	Ability to **design** various components of RC moment frame building subjected to gravity and lateral loads.			√									

3	Ability to **apply modern tools** for analysis and design of structures and individual components					√							

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **analyze** an RC moment frame building for lateral loads.	2	C4	3	-	4	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **design** various components of RC moment frame building subjected to gravity and lateral loads.	3	C5	2	-	5	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **apply modern tools** for analysis and design of structures and individual components	9	C5	5	-	5	Quiz and Continuous Assessment

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 12 weeks)	36
Guided Learning Tutorial/ Assignments (1 hours/week x 6 weeks)	6
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	 8 7

Assessment Quiz+Viva	3
Total	60

TEACHING METHODOLOGY

Lecture and Discussion,, Problem Based Learning (PBL)

TEACHING SCHEDULE

Weeks	Topic	Assessments
1	Introduction Acquaintance with individual data Load Calculation for slab and beam	Assignment, Continuous Assessment, Quiz
2	Slab design	
3	Earthquake and Wind load Calculation	
4	Moment Distribution on frame	
5	Design of the beam and column	
6	Design of Pile and Pile Cap	
7	Quiz	
8	Introducing the building plan and the individual design data to students.	Assignment, Continuous Assessment, Quiz
9	Acquainting the class with ETABS 2015 Acquaintance with the interface of ETABS 2015 Defining grid, material properties and section properties	
10	Complete modelling of an 8 storied residential building.	
11	Assigning gravity load with appropriate load combinations to the model and interpretation of the analysis results. Assigning lateral loads according to BNBC 2020. Interpretation of the analysis results and checking the design output parameters with hand calculation.	
12	Design of foundation	

13	Design of Shear wall	
14	Quiz + Viva	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Lab Report)	40%	CO1	C4
		CO2	C5
		CO3	C2, C3
Quiz 1 & Quiz 2	60%	CO1	C4
		CO2	C5
Total Marks	100%		

REFERENCE BOOKS

1. Design of Concrete Structures by – Winter &Nilson (10th Edition)
2. Design of Concrete Structures by – Nilson (12th Edition)
3. Bangladesh National Building Code (BNBC)’20

Fall semester L-4, T-II

Sessional (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 412 : Bridge Design Sessional	Lecture contact hours Credit hours	: 3.0 : 1.5

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
Before starting this course, students have already sufficient knowledge in analyze and design of simple concrete structures and their components through CE-315, CE 317, CE-311 and CE-411. In this course, students will learn how to analysis more complicated and mega structures like bridge where they will learn a combination of moving load, prestressing and application of Finite Element (FE) software.

OBJECTIVE
• To analyze the precast prestressed concrete bridge structures • To design the structural components of bridge structures • To apply modern tool for the analysis and design of bridge structures.

COURSE CONTENT
Structural idealization, Structural idealization, Analysis, design and detailing of prestressed concrete bridges (Deck, Girder, Railing, Pier, Pile cap) as per AASHTO LRFD guideline, and computer modelling of the full-scale bridge.

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	Ability to analyse bridge structure.			√									
2	Ability to design components of bridge structure.			√									

3	Ability to apply modern tools to accelerate the analysis and design of structures.					√							

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to analyse bridge structure.	3	C4	3	-	4	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to design components of bridge structure.	3	C4	3	-	5	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to apply modern tools to accelerate the analysis and design of structures.	5	C5	5	-	6	Assignment

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (3 hours/week x 12 weeks)	36
Guided Learning Tutorial/ Assignments (1 hours/week x 6 weeks)	6
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	 8 6

Assessment Quiz+Viva	4
Total	60

TEACHING METHODOLOGY

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

TEACHING SCHEDULE

Week	Topics	Assessments
1	Introduction to the Bridge Structure	Class Assessment, Continuous assessment, Quiz, Viva
2	Preliminary Design: Geometry Selection of Bridge Structure (PC Girder Bridge)	
3	Dead Load and Moving Loads on the Bridge Structures: H-20, HS-20 & HL-93	
4	Lateral Load on the Bridge Structure	
5	Analysis of the Bridge by simplified Methods	
6	Design of the Bridge components	
7	Quiz and viva	
8	Bridge Modelling Using FE Software	Class Assessment, Continuous assessment, Quiz, Viva
9	Introduction to the MIDAS-Civil	
10	Geometry Assignment	
11	Load Application on the FE Model	
12	Analysis Technique and Run Analysis	
13	Design of the Bridge Components	
14	Quiz and Viva	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Continuous Assessment (Lab Report)	50%	CO1	C4
		CO2	C5
		CO3	C2, C3
Quiz 1 & Quiz 2	50%	CO1	C4
		CO2	C5
Total Marks	100%		

REFERENCE BOOKS

1. Bangladesh National Building Code (BNBC)-2012
2. AASHTO LRFD Bridge: Design Specifications 2012

Fall semester L-4, T-I

Sessional (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 414 : Steel Structure Design Sessional	Lecture contact hours Credit hours	: 1.5 : 1.5

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This is the class room design sessional where students will be guided to design and prepare detailing of different components, such as tension member, compression member, connections, column base, of a low-rise steel structure as well as a roof truss. Also, student will be able to model and design steel bridge using software's which will help them in professional life.

OBJECTIVE

- To provide adequate knowledge about tools necessary for designing steel structures.
- To make familiarize with international design codes.
- To provide an understanding of Load from Allowable Stress Design (ASD).
- To design and analyse bridge in software

COURSE CONTENT (2021)
Hand Calculation of medium-rise moment frame steel building (preferably 4-7 storey) considering gravity and lateral loads; design of members, connections and columns bases; roof truss. Analysis and design of a steel bridge using computer software; superstructure design; lane assignment, load assignment including vehicle live load application, analysis, design check of structural components.

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	**Analyze** of different components of structures, i.e., building and roof truss.		√										
2	**Design** of different components of			√									

	structures, i.e., building and roof truss.												
3	**Understand** the basic concept of design software i.e., SAP or similar one.					√							

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Analyze** of different components of structures, i.e., building and roof truss.	2	C4	1	-	4	Class assessments/ Quiz/viva
CO2	**Design** of different components of structures, i.e., building and roof truss.	3	C3	1	-	5	Class assessments/ Quiz/viva
CO3	**Understand** the basic concept of design software i.e., SAP or similar one.	5	P2, P3	1	-	6	Class assessments/ 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 (1hours/week x 10 weeks) Data analysis and calculation (1.5 hr/week X 10 weeks)	10 15
Guided Learning Report Writing (2 hour/week x 10 weeks)	20
Independent Learning Preparation for tests and examination	08
Assessment	

Quiz Viva Class Performance (0.25 hr/week X 10 weeks)	2.5 2 2.5
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture Topic	Assignments
1	Introduction to Truss, supply of design data, Introducing with SAP	Lab reports in every class
2	Design of purlin, calculation of wind load, Design of Sag rod	
3	Calculation of dead load & wind load at different joint of truss, truss analysis using computer software and hand calculation	
4	Design of truss members, Design of bracing systems	
5	Design of welded connections for truss members	
6		Viva and Quiz
7	Introduction to SAP 2000 & analysis of a simple beam element	Lab reports in every class
8	Analysis of a 2D frame	
9	Analysis of a truss	
10	Analysis of a Bowstring Steel Bridge	
11	Analysis of a Bowstring Steel Bridge	
12	Analysis of a Bowstring Steel Bridge	
13	---	Viva and Quiz
14	---	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Continuous Assessment/ Viva/ Reports	40%	CO1, CO2, CO3	C4, C3, P2-P3
Quiz	60%	CO 1	C4

		CO 2	C3
		CO 3	P2-P3
Total Marks	100%		

REFERENCE BOOKS
1. Steel Structures: Design and Behavior by Salmon, Johnson and Malhas (5th Edi) 2. Limit States Design in Structural Steel by G L Kulak and G Y Grondin 3. AASHTO LRFD Bridge: Design Specifications 2012

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 429 : Design of Steel Concrete Composite Structure	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
In this course students will learn about different types of steel-concrete composite columns and floor system. They will also learn to analyze and design different components of composite structures.

OBJECTIVE

- To understand the behavior of steel concrete composite structure
- To evaluate the load carrying capacity of various types of steel concrete composite columns
- To analyze and design of steel concrete floor system

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

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	Ability to **understand** the behaviour of steel concrete composite structure.	√											
2	Ability to **evaluate** the load carrying capacity of various types of steel concrete composite columns.		√										

3	Ability to **analyze** and design of steel concrete floor system.			√									

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** the behaviour of steel concrete composite structure.	1	C2	2	-	4	Class Test, Mid-term, Final Exam
CO2	Ability to **evaluate** the load carrying capacity of various types of steel concrete composite columns.	2	C5	2	-	4	Class Test, Mid-term, Final Exam
CO3	Ability to **analyze** and design of steel concrete floor system.	3	C4	2	-	4	Class Test, Mid-term, Final Exam

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

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 Continuous Assessment	2

Final examination	3
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Introduction to Steel Concrete Composite Structure, Advantages of composite construction	Lecture notes, Reference texts, etc.
	2	Advantages and disadvantages different types of composite column, Shear connector	
2	3	Load carrying capacity of FEC column under axial compression	
	4	Load carrying capacity of FEC column under axial compression	
3	5	Load carrying capacity of FEC column under axial tension	
	6	Load carrying capacity of eccentrically loaded FEC column	
4	7	Load carrying capacity of eccentrically loaded FEC column	
	8	Load Transfer mechanism of FEC column	
5	9	Load Transfer mechanism of FEC column	
	10	Load carrying capacity of CFT column under axial compression	
6	11	Load carrying capacity of CFT column under axial compression	
	12	Load carrying capacity of CFT column under axial tension	
7	13	Load carrying capacity of eccentrically loaded CFT column	
	14	Load carrying capacity of eccentrically loaded CFT column	
8	15	Load Transfer mechanism of CFT column	
	16	Load Transfer mechanism of CFT column	
9	17	Load carrying capacity of PEC column under axial compression	
	18	Introduction to steel concrete floor system	
10	19	Construction stages, Design Consideration, AISC design guideline	
	20	Behavior and analysis of composite beams	
11	21	Behavior and analysis of composite beams	

	22	Behavior and analysis of composite beams	
12	23	Behavior and analysis of composite beams	
	24	Composite beam design	
13	25	Composite beam design	
	26	Composite beam design	
14	27	Composite girder design	
	28	Composite girder design	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2,C4,C5
Final Exam	60%	CO 1	C2
		CO 2	C5
		CO 3	C4
Total Marks	100%		

REFERENCE BOOKS

1. Steel Structures: Design and Behavior by Salmon, Johnson and Malhas (5th Edi)
2. Limit States Design in Structural Steel by G L Kulak and G Y Grondin
3. AISC design guide 2014

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 415 : Prestressed Concrete	Lecture contact hours Credit hours	: 2.00 : 2.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
It is an advanced design course for prestressed concrete structures, provides knowledge about prestressing materials, loss estimation of prestressed concrete member and analysis and design of section for flexure, bond and bearing. Students can familiar with composite sections, beam deflections, layout of cable and partial prestressing etc. In this course, students will also be introduced about the design prestressed concrete beam with simple and continuous span, as per AASHTO Code as well as design consideration for prestressed concrete pipes, piles, poles and railway sleepers which will be useful in various projects in the later semesters and in their professional life.			
OBJECTIVE			
• To be able to understand mechanism of prestressed concrete structure. • To be able to perform analysis and design of prestressed concrete members. • To be able to design prestressed beam with (Simple and continuous span) according code provision. • To gain knowledge about the design consideration of prestressed concrete pipes, poles and railway sleepers.			
COURSE CONTENT			
Prestressed Concrete: concepts of prestressing; materials; anchorage systems; loss of prestress; analysis of sections for flexure, shear, bond and bearing; analysis of end block and composite sections; beam deflections; cable layout; partial prestress. Design of prestressed concrete beams for simple and continuous spans; ideas about use of AASHTO – PCI sections for standard spans; design considerations for prestressed concrete pipes, piles, poles and railway sleepers.			

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	Ability to **understand** the mechanism of prestressed concrete structure and loss estimation.	√											
2.	Ability to **Analyze** the section for flexure, shear and bond including end block.		√										
3	Ability to **analyze** the composite section, and **determine** beam deflections.		√		√								
4	Ability to **design** prestressed concrete beam as per code.			√									
5	**Understand** the design considerations for prestressed concrete pipes, piles, poles and railway sleepers.	√											

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** the mechanism of prestressed concrete structure and loss estimation.	1	C5	1	-	1, 5	Class Test, Mid-term, Pop quiz
CO2	Ability to **analyze** the section for flexure, shear and bond including (End Block)	2	C3	2,3	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam

CO3	Ability to **analyze** the composite section, and **determine** beam deflections.	2,4	C2, C3	3	-	4,5	Assignment, Pop quiz, Class Test Final Exam
CO4	Ability to **design** prestressed concrete beam with (Simple and continuous span) as per code.	3	C3	3,5	-	4,5	Class Test, Mid-term, Pop quiz, Final Exam
CO5	**Understand** the design considerations for prestressed concrete pipes, piles, poles and railway sleepers.	1	C5	1	-	4	Class Test, 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 (4 hours/week x 3 weeks)	12
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	20 15
Assessment Continuous Assessment Final examination	2 3
Total	80

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE			
Week	**Lecture**	**Topics**	**Assessments**
1	1	Basic Concept of Prestressing methods.	CT/ Assignment/ Final Exam
	2	Basic Concept of Prestressing methods.	
2	3	Prestressing materials, Anchorage system.	
	4	Loss of prestress for beam.	
3	5	Loss estimation of prestress beam (Math)	
	6	Analysis of section for flexure.	
4	7	Analysis of section for flexure.	CT/ Assignment/ Final Exam
	8	Analysis of section for shear	
5	9	Analysis of section for bond and bearing.	
	10	End Block analysis of member.	
6	11	Analysis of Composite section.	Mid Term/ Assignment/ Final Exam
	12	Analysis of Composite section.	
7	13	Analysis of Composite section.	
	14	Beam deflections; cable layout; partial prestress	
8	15	Beam deflections; cable layout; partial prestress	
	16	Design of prestressed concrete beams for simple spans.	
9	17	Preliminary Design of beam.	
	18	Design of prestressed concrete beams for simple spans;	
10	19	Design of prestressed concrete beams for simple spans;	
	20	Design of prestressed concrete beams for continuous spans;	
11	21	Design of prestressed concrete beams for continuous spans;	
	22	Design of prestressed concrete beams for continuous spans;	
12	23	Ideas about use of AASHTO – PCI sections for standard spans;	CT/ Assignment/ Final Exam
	24	Ideas about use of AASHTO – PCI sections for standard spans;	

13	25	Design considerations for prestressed concrete pipes, piles.	
	26	Design considerations for prestressed concrete pipes, piles.	
14	27	Design considerations for prestressed concrete poles and railway sleepers.	
	28	Design considerations for prestressed concrete poles and railway sleepers.	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4, CO5	C2, C3, C5
Final Exam	60%	CO 2	C3
		CO 3	C2, C3
		CO 4	C3
		CO5	C5
Total Marks	100%		

REFERENCE BOOKS

1. Design of Prestressed Concrete Structure by – T.Y. Lin, Ned H. Burns (3rd Edition)
2. Prestressed Concrete Structures by Michael P Collins
3. AASHTO-LRFD CODE 2012.

Fall Semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 417 : Design of Concrete Structures III	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
It is an advanced design course for reinforced concrete structures, provides knowledge about design and analyzes of structural component for torsion, design of slab system, deep beam design, slender column etc. In this course, students will also be introduced about the design and detail drawing of reinforcement at joint and lift cores, diaphragm which will be useful in various projects and in their professional life.

OBJECTIVE
• To gain knowledge on the advance topic of reinforced concrete structure. • To become skilled at the design of slab and torsion for beam. • To become aware of the lateral load resisting design and detailing of concrete structures.

COURSE CONTENT
Analysis and design for torsion; design of one way and two-way joist slabs with or without beam on the column line; slender columns; strut-and-tie models (design of deep beam), design of reinforcement at joints; design and detailing of lateral load resisting components. lift cores, diaphragm etc.

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	Ability to **Analyse** the components of structure under torsion.			√									
2	Ability to **design** the structural components of a reinforced concrete slabs and columns.		√										

		1	2	3	4	5	6	7	8	9	10	11	12
3	Ability to **produce** details structural drawings for lateral load resisting components.		√										
4	Ability to **apply** the strut-and-tie models concept for deep beam design.	√											

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **Analyse** the components of structure under torsion.	3	C4	1, 2	-	3, 4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **Design** the structural components of a reinforced concrete slabs and columns.	2	C4	1, 2	-	3, 4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **produce** details structural drawings for lateral load resisting components.	2	C4	5	-	3, 4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO4	Ability to **apply** the strut-and-tie models concept for deep beam design.	1	C3	5	-	3, 4, 5	Mid-term, Final Exam
WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile							

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 Continuous Assessment Final examination	 2 3
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Analysis of Structural Component for Torsion	CT/ Assignment/ Final Exam
	2	Analysis of Structural Component for Torsion	
2	3	Design of Components for Torsion.	
	4	Design of Components for Torsion.	
3	5	Preliminary Guideline of one-way joist slab system	
	6	Preliminary Guideline of two-way joist slab system	
4	7	Design of slab with beams on column line	
	8	Design of slab with beams on column line	
5	9	Design of slab with beams on column line	
	10	Design of slab without beams on column line	
6	11	Design of slabs without beams on column line.	Mid Term/ Assignment/ Final Exam
	12	Design of slabs without beams on column line.	
7	13	Design of Slender Column.	
	14	Design of Slender Column.	
8	15	Design of Deep Beam (Strut and Tie Model)	
	16	Design of Deep Beam (Strut and Tie Model)	
9	17	Design of Deep Beam (Strut and Tie Model)	
	18	Design of Deep Beam (Strut and Tie Model)	

10	19	Design of reinforcement at joints	
	20	Design of reinforcement at joints	
11	21	Design of reinforcement at joints	
	22	Design of reinforcement at joints	
12	23	Design lateral load resisting components. lift cores,	CT/ Assignment/ Final Exam
	24	Design lateral load resisting components. lift cores	
13	25	Guideline of detailing of lift cores	
	26	Guideline of detailing of lift cores	
14	27	Design of diaphragm	
	28	Design of diaphragm	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C4
Final Exam	60%	CO 1	C4
		CO 2	C4
		CO 3	C4
		CO 4	C3
Total Marks	100%		

REFERENCE BOOKS

1. Design of Concrete Structures, Arthur H. Nilson, David Darwin and Charles W. Dolan, McGraw Hill, 15th Edition.
2. Reinforced Concrete: Mechanics and Design, James Wight and James MacGregor, Pearson, 6th Edition.
3. Reinforced Concrete: A Fundamental Approach, Edward G. Nawy, Pearson, 5th Edition.
4. Design of Reinforced Concrete, Jack C. McCormac and James K. Nelson, John Wiley & Sons, Inc., 7th Edition.
5. Bangladesh National Building Code (BNBC)

Spring Semester L-4, T-I

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 419 : Introduction to Finite Element Method	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
The course provides basic knowledge on the application of finite element analysis to engineering applications in linear structural mechanics. The course analyses critically problems involving one-, two- and three-dimensional idealizations. The topics covered include steps in finite element modelling process, behaviour of spring, truss, beam, plane stress/strain and three-dimensional finite element modelling approaches in structural mechanics.

OBJECTIVE
• Implement the basics of FEM to relate stresses and strains. • Formulate the design and heat transfer problems with application of FEM. • Solve 1 D, 2 D and dynamic problems using Finite Element Analysis approach.

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

COURSE OUTCOMES AND SKILL MAPPING

No.	COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Ability to **understand** basic concepts of finite element method.	√											

2	Ability to **solve** 1-D problems.		√									
3	Ability to **implement** the formulation techniques to solve two-dimensional problems.		√									
4	Ability to **use** software to perform analysis of complex problem.					√						

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** basic concepts of finite element method	1	C2	1	-	1	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **solve** 1-D problems	2	C4	1, 2	-	2, 3, 4	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **implement** the formulation techniques to solve two-dimensional problems	2	C4	1, 2	-	2, 3, 4	Class Test, Mid-term, Final Exam
CO4	Ability to **use** software to perform analysis of complex problem	5	C3	7	-	2	Assignment

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

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 Continuous Assessment Final examination	2 3
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Assessments
1	Introduction to finite element analysis, approach method	CT/ Assignment/ Final Exam
	Introduction to finite element analysis, approach method	
2	Direct methods, stiffness method, elements and nodes	
	Direct methods, stiffness method, elements and nodes	
3	One-dimensional bar members, local and global coordinate systems, global matrix	
	One-dimensional bar members, local and global coordinate systems, global matrix	
4	One-dimensional bar members, local and global coordinate systems, global matrix	
	One-dimensional bar members, local and global coordinate systems, global matrix	
5	One-dimensional bar members, local and global coordinate systems, global matrix	Mid Term Exam/ Assignment / Final Exam
	One-dimensional bar members, local and global coordinate systems, global matrix	
6	Two-Dimensional (2D) Element	

	Two-Dimensional (2D) Element	
7	Two-Dimensional (2D) Element	
	Two-Dimensional (2D) Element	
8	Basic concepts of plane stress and plane strain	
	Basic concepts of plane stress and plane strain	
9	Modeling techniques used in finite element analysis	CT/ Assignment/ Final Exam
	Modeling techniques used in finite element analysis	
10	Integral Formulations and Their Application in The Finite Element Method	
	Integral Formulations and Their Application in The Finite Element Method	
11	Integral Formulations and Their Application in The Finite Element Method	
	Integral Formulations and Their Application in The Finite Element Method	
12	Three-Dimensional Stress Analysis	
	Three-Dimensional Stress Analysis	
13	Introduction to Finite Element Software	
	Introduction to Finite Element Software	
14	Introduction to Finite Element Software	
	Introduction to Finite Element Software	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C3, C4
Final Exam	60%	CO 1	C2

		CO 2	C4
		CO 3	C4
Total Marks	100%		
REFERENCE BOOKS			

1. Bathe, K.J., “Finite Element Procedures”, 1996.
2. Zienkiewicz, O.C. and Morgan, K., “Finite Elements and Approximation”, John Wiley and Sons, 1983.
3. Cook, R.D., “Finite Element Modelling for Stress Analysis”, John Wiley and Sons, 1995.
4. D.L. Logan, “A First Course in the Finite Element Method”, Third Edition, Thomson Learning, 2001, TA347.F5L 64.
5. J.N. Reddy, “An Introduction to the Finite Element Method”, Second Edition, McGraw-Hill International Editions, Singapore.
6. Grandin, H., “Fundamentals of the Finite Element Method”, Macmillan Publishing Company, 1986.
7. Weaver, W. And Johnston, P.R., “Finite Elements for Structural Analysis”, Prentice-Hall, 1984.
8. Beer, G. And Watson, J.O., “Introduction to Finite and Boundary Element Methods for Engineers”, John Wiley and Sons, 1992.

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION

Course Code	: CE 421	Lecture contact hours	: 2.00
Course Title	: Dynamics of Structures	Credit hours	: 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

Structural dynamics is a basic course in defining and understanding dynamic problems mainly related to civil engineering. The course is intended to provide necessary knowledge to establish the equations of motion and for the determination of structural response from dynamic loads and experience in the modeling and calculation of dynamic response for simple structural systems. The knowledge gained through this course will be useful later on in various projects.

OBJECTIVE

- Learn how to model single-degree and vibratory systems and calculate the free and forced response of these systems.
- Ability to apply the structural dynamics theory to real world problems like seismic analysis and design of structures.

COURSE CONTENT

Single degree of freedom system, free vibration response; response to harmonic, impulse and general dynamic loading; numerical evaluation of dynamic response; earthquake response of linear system; two degrees of freedom system; response spectrum analysis.

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	Ability to **demonstrate** the dynamic behaviour of structural systems	√											
2	Ability to **find** response of structural systems under dynamic load		√										

3	Ability to **devise** mathematical model for solving field problems			√									

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **demonstrate** the dynamic behaviour of structural systems	1	C3	1, 2	-	1, 2	Class Test, Mid Term, Final and class participation
CO2	Ability to **find** response of structural systems under dynamic load	2	C4	2	-	2, 3	Class Test, Mid Term, Final and class participation
CO3	Ability to **devise** mathematical model	3	C6	3	-	4	Class Test, Mid Term, Final and class participation

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	24 13
Assessment	

Pop Quiz/Class Test/Mid-Term Exam Final examination	03 02
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Assessments
1	Dynamics of single-degree-of-freedom systems	Pop Quiz/Class Test/Mid-Term Exam
2	Equations of Motion, Problems and Solutions	
3	Undamped Free Vibration, Viscously Damped Free Vibration	
4	Energy in Free Vibration	
5	Response to Harmonic and Periodic Excitations	
6	Systems with Nonviscous Damping, Response to Periodic Excitation	
7	Response to Arbitrarily Time-Varying Forces, Response to Step and Ramp Forces	
8	Response to Pulse Excitations	
9	Earthquake Excitation and Motion, Response Spectrum Analysis	
10	Systems with Distributed Mass and Elasticity	
11	Natural Vibration Frequency by Rayleigh's Method	
12	One-Story Unsymmetric-Plan Buildings,	
13	Multistory Unsymmetric-Plan Buildings	
14	Free Vibration Response for Multi-Degree-of-Freedom Systems	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous assessment	40%	CO1, CO2, CO3	C3, C4, C6

Final examination	60%	CO 1	C3
		CO 2	C4
		CO 3	C6
Total Marks	100%		

REFERENCE BOOKS

1. Dynamics of Structures - Theory and Applications to Earthquake Engineering, 5th Edition by Anil K. Chopra, Pearson Prentice Hall, 2016
2. Dynamics of Structures - R.W. Clough and J. Penzien, 2nd Edition

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 423 : Structural Safety	Lecture contact hours Credit hours	: 2.00 : 2.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
The method for safety evaluation and risk assessment of civil structures will be studied. Definition of loadings and structural safety will be given in a probabilistic framework. Risk assessment of civil structures in earthquake regions will be analyzed with details. The knowledge gained through this course will be useful later on in various projects.			
OBJECTIVE			
• The student will gain a basic understanding of and a general awareness on safety aspects in structural and civil engineering, and will be able to judge whether it is necessary to account for uncertainties in engineering problems. • When simplified deterministic procedures are applied, the student can critically reflect the implications of the simplifications. • With basic understanding the student will be able to ask the right questions also for more advanced problems and might consult experts for their solution.			
COURSE CONTENT			
Structural Safety is a course to integrate risk assessment for a wide range of constructed facilities such as buildings, bridges, earth structures, offshore facilities, dams, lifelines and nuclear structural systems, especially RCC and steel structures. Its purpose is to gain in-depth knowledge about risk and reliability among technical disciplines involved in design and construction, and to enhance the use of risk management in the constructed environment. All aspects of quantitative safety assessment and to addresses the protection of structures and infrastructure such as buildings and bridges both RCC and Steel structures exposed to multiple hazards, including earthquakes, cyclones, fire hazards, hurricane, surge or corrosion.			

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	Ability to **formulate** simple probabilistic models that represent relevant engineering phenomena.	√											
2	Ability to **define** adverse events (like failure or malfunction) in terms of limit states and assess the probability of these adverse events.	√											
3	Ability to **perform** the reliability-based calibration of structural codes.			√									

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **formulate** simple probabilistic models that represent relevant engineering phenomena	1	C3, C4	1, 2	-	2, 3	Class Test, Mid Term, Final and class participation
CO2	Ability to **define** adverse events (like failure or malfunction) in terms of limit states and assess the probability of these adverse events	1	C2, C3	3	-	1, 4	Class Test, Mid Term, Final and class participation

CO3	Ability to **perform** the reliability-based calibration of structural codes	3	C4, C5	5	-	5	Class Test, Mid Term, Final and class participation

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	24 13
Assessment Pop Quiz/Class Test/Mid-Term Exam Final examination	03 02
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	**Topics**	**Assessments**
1	Review of conceptual design	Pop Quiz/Class Test/Mid-Term Exam/ Final Exam
2	Review of probability theory	
3	Structural Component reliability analysis	
4	Analysis of uncertainties - Bayesian Reliability analysis	
5	Structural Systems Reliability analysis	
6	Simulation methods	
7	Probabilistic codified Design	
8	Examples of "Robust" structural design	

9	Examples of structural failures	
10	The role of conceptual design in structural reliability	
11	System Reliability	
12	Structural Code Concepts, Code Calibration	
13	Re-evaluation of the safety of existing structures	
14	Aspects of quality control	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous assessment	40%	CO1, CO2, CO3	C2, C3, C4, C5
Final examination	60%	CO 1	C3, C4
		CO 2	C2, C3
		CO 3	C4, C5
Total Marks	100%		

REFERENCE BOOKS

1. AISC Seismic Provisions for Structural Steel Buildings, ANSI/AISC 341-10
2. Structural Seismic Design Optimization and Earthquake Engineering: Formulation and Applications by Vagelis Plevris, Chara Ch. Mitropoulou, Nikos D Lagaros, 2012
3. Computational Methods in Earthquake Engineering by Papadrakakis, Fragiadakis and Lagaros, 2011
4. Journal of Structural Safety by Elsevier (for case studies)

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION

Course Code	: CE 427	Lecture contact hours	: 2.00
Course Title	: Advanced Solid Mechanics	Credit hours	: 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course will teach the students to solve problems in solid mechanics which cannot be satisfactorily addressed by the approaches of mechanics of materials. The focus is on analytical methods and introductions to numerical methods are also covered. The knowledge gained through this course will be useful later on in various projects.

OBJECTIVE

- To expand on the basic principles established previously in Solid Mechanics.
- To consolidate the solid mechanics principles presented in the student’s Engineering degree, and the equip students with skills required to solve a range of engineering problems they have not seen before.

COURSE CONTENT

Stress, strain and displacements in two and three dimensions. Constitutive equations. Governing equations of elasticity and simple solutions, Formulation of basic equations of elasticity in solid mechanics, Strain energy. Theories of failure.

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	Ability to **solve** problems in elasticity using fundamental equations	√											
2	Ability to **evaluate** the principal stress and principal strain for a given state of stress or strain		√										

3	Ability to **formulate** the usage of energy methods for solving structural problems		√	√									

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **solve** problems in elasticity using fundamental equations	1	C2, C3	1, 2	-	1, 2	Class Test, Mid Term, Final and class participation
CO2	Ability to **evaluate** the principal stress and principal strain for a given state of stress or strain	2	C5	2	-	2	Class Test, Mid Term, Final and class participation
CO3	Ability to **formulate** the usage of energy methods for solving structural problems	2, 3	C2, C3	3	-	3	Class Test, Mid Term, Final and class participation

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	24 13
Assessment Pop Quiz/Class Test/Mid-Term Exam Final examination	03 02
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Assessments
1	Introduction to stress analysis in elastic solid	Pop Quiz/Class Test/Mid-Term Exam/Final Exam
2	Hydrostatic and deviatoric stress components, octahedral shear stress	
3	Analogy between stress and strain tensors	
4	Constitutive equations – generalized Hooke‟s law	
5	Equations for linear elastic isotropic solids	
6	Boundary conditions – St. Venant‟s principle for end effects Uniqueness theorem	
7	Plane stress and plane strain problems	
8	Stress compatibility equation - Plane Stress	
9	Stress compatibility equation - Plane Strain	
10	Equilibrium equations, strain-displacement relations	
11	Axisymmetric problems	
12	Strain tensor	
13	Compatibility conditions	
14	Relation among elastic constants	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous assessment	40%	CO1, CO2, CO3	C2, C3, C5
Final examination	60%	CO 1	C2, C3
		CO 2	C5
		CO 3	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. Advanced Strength and Applied Elasticity, 5th Edition, by A C Ugural and S K Fenster
2. The geometrical Language of Continuum Mechanics by Marcelo Epstein

5.9 Environmental Engineering

Spring semester L-3, T-I

Theoretical (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 331 : Environmental Engineering-I	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This course provides an overview to different aspects of Environmental Engineering. The interconnectedness of the environmental system is emphasized. Students will also learn to deal with technical aspects of drinking water treatment, collection and distribution, and will pay attention to the choice of technologies and tools, ranging from low-cost to advanced options, which will be useful in in their professional life.			
OBJECTIVE			
• To develop a basic understanding of environmental engineering especially on water supply engineering. • To learn water quality criteria and standards, and their relation to public health, environment and urban water cycle • To familiarize with drinking water supply systems, including water transport, treatment and distribution. • To understand physical, chemical and biological phenomena, and their mutual relationships, occurring within water supply systems. • To recognize water quality concepts and their effect on treatment process selection.			
COURSE CONTENT			
Introduction to Environmental Engineering: water, sanitation, ecology and environment; climate change; biodiversity; contemporary environmental issues. Water Supply Engineering: Water requirement in urban (water demand, population prediction, water demand for street fire hydrant and interior fire protection) and rural communities; the hydrologic cycle and water availability; water supply sources; ground water exploration: aquifer properties and ground water flow, well hydraulics, water well design, drilling, construction and maintenance; shallow hand tubewells, deep tubewells, deep set pumps, pond sand filter, rain water harvesting system and alternative water supplies for problem areas. Surface water collection and transportation; pumps and pumping machineries; water distribution systems; fire hydrants; water meters; water loss control (auditing, unaccounted for water, leak detection and water conservation).			

Water quality requirements; water treatment: plain sedimentation, coagulation, flocculation, filtration, disinfection; miscellaneous treatment methods; low cost treatment methods (arsenic/iron removal plants etc.) for rural communities; water safety plans; Advanced oxidation, introduction of nanotechnology.

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	Ability to e**stimate** the fresh water demand and assess the requirements for preferred water supply system in urban as well as rural areas.	√											
2	Ability to i**dentify** problem specific solutions to provide fresh water supply options including groundwater well and RWH in urban as well extremely water shortage areas.	√											
3	Ability to **Apply** Engineering perception to construct complex water supply distribution networks in terms of economic, public health, Environment and sustainability .							√					
4	Ability to **Analyse** water quality data and related treatment methods to design and construct efficient and cost-effective water treatment plant, with			√									

	appropriate consideration for public health and safety.												

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **estimate** the fresh water demand and assess the requirements for preferred water supply system in urban as well as rural areas compression member, flexural member.	1	C2	1	-	3	Class Test, Mid-term, Final Exam
CO2	Ability to **identify** problem specific solutions to provide fresh water supply options including groundwater well and RWH in urban as well extremely water shortage areas	1	C2	1	-	3	Class Test, Mid-term, Final Exam
CO3	Ability to **Apply** Engineering perception to construct complex water supply distribution networks in terms of economic, public health, Environment and sustainability.	7	C3	3	3	5	Class Test, Mid-term, Group Assignment Final Exam
CO4	Ability to **Analyse** water quality data and related	3	C4	2		4	Class Test, Mid-term, Final Exam

	treatment methods to design and construct efficient and cost-effective water treatment plant, with appropriate consideration for public health and safety.						

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 3weeks)	09
Independent Learning Individual learning Preparation for tests and examination	 18 46
Assessment Continuous Assessment Final examination	 2 3
Total	120

TEACHING METHODOLOGY

Lecture and Discussion, Tutorials, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	**Lecture**	**Topics**	**Assessments**
1	1	Background of Environmental Engineering, water supply, health and sanitation, history and development of water supply Engg.	Mid-Term Exam
	2	Importance of water supply Eng., Elements of public water supply, Sources of water supply	

	3	Environment and Environmental impacts on Human Life, Water supply, health and sanitation, Ecology and Environment, Role of Environmental Engineer	
2	4	Population Estimation and water demand forecasting	Class Test
	5	Fire demand calculation and fire hydrant design	
	6	Suitability of sources with regards to quantity and quality, Choice of sources for water supply	Mid-Term Exam
3	7	Aquifer properties, basic definitions, types of aquifers, confined and unconfined aquifers	
	8	Groundwater hydraulics, porosity, seepage, infiltration, permeability	
	9	Surface water collection units, Water treatment units	
4	10	Darcy's law, discharge equation for confined aquifers with example problems	
	11	Discharge equation for unconfined aquifers with example problems	
	12	Water distribution system, Distribution methods	
5	13	Withdrawal of excessive groundwater, consequences of groundwater abstraction	
	14	Basic concept of water well design, sieve analysis, bore hole construction	
	15	Water transmission line design	
6	16	Gravel pack design	
	17	Well drilling and construction	Group Assignment, Final Exam
	18	Single pipe design, Serial and branched networks	
7	19	Water well maintenance	
	20	Problems of groundwater in Bangladesh	
	21	Looped networks, Hardy Cross Method	
8	22	Pump and pumping machineries, Requirement of water pump	
	23	Water impurities, water quality requirements	Class Test, Final Exam
	24	Water quality standards	
9	25	Plain sedimentation	
	26	Coagulation, Flocculation	

	27	Pump performance curve	Final Exam
10	28	Filtration	
	29	Disinfection	
	30	Surface water intake design	
11	31	Iron and Manganese removal	
	32	Arsenic removal	
	33	water supply in coastal saline affected areas	
12	34	Alternative and Low-cost water supply options	Class Test, Final Exam
	35	Taste and odour control	
	36	Water softening	
13	37	Auditing of water, Leak detection in water mains, Using water efficient appliances and fixture	Final Exam
	38	Advanced Oxidation, Membrane technologies – reverse osmosis	
	39	Introduction to nanotechnology in environmental engineering	
14	40	Water safety through water safety plans , Water demand management, Water charging/ tariff, Water conservation	
	41	Developing a WSP	
	42	Review of water treatment options with examples	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2	C2, C2
Final Exam	60%	CO 3	C3
		CO 4	C4
Total Marks	100%		

REFERENCE BOOKS
1. Water Supply Engg. MA Aziz. 2. Water Supply and Sanitation, M Feroze Ahmed and MM Rahman. 3. Groundwater Hydrology, 3rd Edition, David Keith Todd, Larry W. Mays. 4. Principles of Water Treatment, Kerry J. Howe, David W. Hand. 5. Water Supply Engineering, SK Gerg. 6. Integrated Design and Operation of Water Treatment Facilities (2nd Edition). Susumu Kawamura. 7. Water Safety Plan (WSP) – A Risk Based Approach for Water Safety 1st Ed., ITN-BUET. 8. Water and Environmental Engineering: M. Habibur Rahman, Abdullah Al-Muyeed, 1st Ed., ITN-BUET.

Fall semester L-3, T-II

Theoretical (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 333 : Environmental Engineering-II	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This is the second course on environmental engineering where students will be presented with basic knowledge on waste water technology and sanitation, design and construction of sewer, STP and ETP plant and sanitation system. Students will also learn about the environmental impact assessment. Knowledge gained from this course will be used in later semester and also in the professional career.			
OBJECTIVE			
• To gain knowledge on the basics of waste water technology and sanitation options. • To comprehend at the design and construction of sanitary sewer, storm sewer, waste water treatment plant. • To learn about the details of sewage treatment methods and design of treatment units. • To understand the importance of sludge management and learn about the sludge treatment facilities. • To acquaint with the sanitation technologies, especially practiced in low-income and developing countries around the world and learn to design those facilities knowing the appropriateness of technologies suitable to specific site condition.			
COURSE CONTENT			
Wastewater Engineering: introduction; water supply, sanitation and health; estimation of wastewater; wastewater collection systems; hydraulics of sewer; design, construction and maintenance of sanitary sewer and storm drainage system; sewer appurtenances; plumbing system. Microbiology of sewage and waste water; wastewater characteristics; preparatory, primary and secondary treatment methods and disposal; treatment and disposal of industrial effluents; sludge treatment and disposal; sanitation for low-income communities – on-site sanitation systems for rural communities; low-cost small-bore sewerage for small townships; design and construction of septic tanks, soak wells and subsurface drain fields; Rural sanitation in Bangladesh. Sustainability of water and sanitation services; participatory development approach in water and sanitation sector; community management of water and			

sanitation services; introduction to environment, Environmental pollution; environment protection and management.													
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	Ability to **estimate** the waste water, solid waste and human waste generation rate and assess the requirements for preferred sanitation system in urban as well as rural areas.	√											
2	Ability to i**dentify** likely Environmental impacts/risks prior to start construction of any development projects so that adverse environmental impacts could be minimized timely and effectively.							√					
3	Ability to **Apply** Engineering perception to construct sewerage networks and building plumbing in terms of economic, public health, Environment and sustainability.							√					
4	Ability to **Analyse** waste-water data and related treatment options to **design** efficient and cost effective ETP and			√									

	STP with appropriate consideration for public health and safety.												

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **estimate** the waste water, solid waste and human waste generation rate and assess the requirements for preferred sanitation system in urban as well as rural areas.	1	C2	1	-	3	Class Test, Final Exam
CO2	Ability to i**dentify** likely Environmental impacts/risks prior to start construction of any development projects so that adverse environmental impacts could be minimized timely and effectively.	7	C2	1	-	3	Class Test, Final Exam
CO3	Ability to **Apply** Engineering perception to construct sewerage networks and building plumbing in terms of economic, public health, Environment and sustainability.	7	C3	2	1	4, 7	Mid Term Exam, Final Exam

CO4	Ability to **Analyse** waste-water data and related treatment options to **design** efficient and cost effective ETP and STP with appropriate consideration for public health and safety.	3	C4	3	4	5	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)	56
Guided Learning Tutorial/ Assignments (4 hours/week x 3weeks)	12
Independent Learning Individual learning Preparation for tests and examination	 22 65
Assessment Continuous Assessment Final examination	 2 3
Total	160

TEACHING METHODOLOGY

Lecture and Discussion, Tutorials, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessment
1	1	Importance of Waste water Engg. Introduction of water supply and waste water production	Final Exam
	2	Significance of waste water, where does it come? Generation of waste water	
	3	Water, sanitation and health, Objectives of environmental sanitation Classification of Wastes and Sanitation Systems	CT, Final Exam

<table>
<tr><td></td><td>4</td><td>Functions of sanitation system
Types of sanitation system, Appropriateness of sanitation system
Criteria for a good sanitation system</td><td></td></tr>
<tr><td rowspan="4">2</td><td>5</td><td>Estimation of waste water flow, discharge computation</td><td rowspan="2">Final Exam</td></tr>
<tr><td>6</td><td>Per capita waste water generation, Daily discharge, seasonal variation, peak discharge</td></tr>
<tr><td>7</td><td>On-site sanitation systems for rural & low-income urban communities
Simple pit technology – design considerations and design</td><td rowspan="2">Final Exam</td></tr>
<tr><td>8</td><td>Two pit latrine systems – design considerations and design</td></tr>
<tr><td rowspan="4">3</td><td>9</td><td>Characteristics of waste water, dissolved solids, suspended solids</td><td rowspan="12">Midterm, Final Exam</td></tr>
<tr><td>10</td><td>Nutrients in waste water and oxygen demand</td></tr>
<tr><td>11</td><td>Ventilated Improved Pit (VIP) Latrine, Reed Odorless Earth Closet (ROEC)</td></tr>
<tr><td>12</td><td>Pour-flash sanitation technologies – design considerations and design</td></tr>
<tr><td rowspan="4">4</td><td>13</td><td>BOD, COD, DO</td></tr>
<tr><td>14</td><td>Environmental problems of untreated waste water</td></tr>
<tr><td>15</td><td>Pour-flash sanitation technologies – design considerations and design</td></tr>
<tr><td>16</td><td>Septic tank – design considerations</td></tr>
<tr><td rowspan="4">5</td><td>17</td><td>Eutrophication, turbidity and water pollution</td></tr>
<tr><td>18</td><td>Sewer, Sewerage and sewage, Collection of waste water, combined system and separate system</td></tr>
<tr><td>19</td><td>Soak pit design</td></tr>
<tr><td>20</td><td>Disposal of septic tank effluent</td></tr>
<tr><td rowspan="4">6</td><td>21</td><td>Sewer hydraulics, Manning’s equations, curved sewers</td><td rowspan="3">CT, Final Exam</td></tr>
<tr><td>22</td><td>Derivation of Partial flow equations, hydraulic element diagrams</td></tr>
<tr><td>23</td><td>Small Bore Sewerage (SBS) system
Changes in design criteria for SBS compared to Conventional Sewerage System</td></tr>
<tr><td>24</td><td>Simplified/ shallow sewerage system, Design principles and design</td><td rowspan="2">Final Exam</td></tr>
<tr><td>7</td><td>25</td><td>Basic considerations of Sanitary sewer and storm sewer design</td></tr>
</table>

	26	Example of sanitary sewer design of a community	
	27	Ecological sanitation technologies	
	28	Composition and types of sewage, Physical, chemical and biological characteristics of sewage, Environmental significance of contaminants	
8	29	Sulfide generation, sewer inspection, construction and maintenance of sewers	
	30	Sewer appurtenances, manhole, Sewer test	CT, Final Exam
	31	Sewage treatment – purpose, phases and unit operations, Preliminary treatment methods – Screening, cutting screen or comminutors and grit chambers	
	32	Preliminary treatment methods – Skimming tank, preaeration and flow equalization	
9	33	Importance, history and development of plumbing system	
	34	Design of plumbing system for an apartment	
	35	Primary treatment methods – Sedimentation, septic tank (review)	Final Exam
	36	Primary treatment methods – Imholf tank, dissolved air flotation	
10	37	Introduction to EIA,	
	38	Example of an EIA document	
	39	Secondary treatment – purpose, biological treatment mechanism Important organisms involved in biological treatment	
	40	Role of bacteria in sewage treatment, Bacterial growth pattern in biological treatment, Relation between Food/Microorganism (F/M) ratio and biomass settling characteristics	
11	41	Solid waste problems in Dhaka City	
	42	SWM: Composting and sanitary landfill	
	43	Types of biological treatment process, Activated sludge process Significance of F/M ratio in activated sludge process	
	44	Trickling Filter process – mechanisms and biological processes Advantages, disadvantages, influencing factors in trickling filter process, Design of trickling filter	

12	45	Sustainability of water and sanitation services	CT-4, Final Exam
	46	participatory development approach in water and sanitation sector	
	47	Waste stabilization ponds – process involved, advantages, disadvantages, Types of stabilization ponds	
	48	Anaerobic pond, facultative pond and maturation ponds, Design preliminaries for waste stabilization ponds	Final Exam
13	49	community management of water and sanitation services; introduction to environment	
	50	Introduction of food sanitation	
	51	Design of waste stabilization ponds	
	52	Effluent disposal methods	
14	53	E-waste	
	54	Env Risk Assessment	
	55	Sludge – types, characteristics, Collection of sludge	
	56	Importance of sludge management, Sludge treatment and disposal methods	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C2, C3
Final Exam	60%	CO 1	C2
		CO 2	C2
		CO 3	C3
		CO 4	C4
Total Marks	100%		

REFERENCE BOOKS

1. Environmental Engineering – Howard S. Peavy, Donald R. Rowe.
2. CE 333 Handouts and Class Lectures.
3. Water Supply, waste disposal and Sanitary Engineering – AK Chatterjee.

4. Water Supply and Sanitation – M Feroze Ahmed and MM Rahman.
5. Environmental Sanitation, Wastewater Treatment and Disposal – Tanveer Ferdous Saeed, Abdullah Al-Muyeed, Tanvir Ahmed.
6. Wastewater Engineering- Metcalf and Eddy.
7. Water Supply and Sewerage- Terence J. McGhee.

Spring semester L-3, T-I

Sessional (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 332 : Environmental Engineering Sessional-I	Lecture contact hours Credit hours	: 3.00 : 1.50

PRE-REQUISITE

Chem 101, 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 their professional life.

OBJECTIVE

- To impart knowledge to determine and analyse different parameters and substances in water.
- To make the students efficient in performing different environmental experiments to satisfy specific needs and interpret the findings.
- To introduce the students with standard procedure, how the test of water samples is conducted according to the standard code.

COURSE CONTENT

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

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	Ability to **use** instruments to analyse water quality parameters with their standard test protocol		√										

	in terms of Engineering practice.												
2	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.				√								

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **use** sophisticated instruments to analyse water quality parameters with their standard test protocol in terms of Engineering practice.	2	C3	5	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.	4	C4	3	4	4	Viva, Quiz

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

TEACHING 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)	 2 1 2.5
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Tutorials, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	**Name of the Experiment**	**Assessment**
1	Introduction, units of measurements, sampling procedure	Viva, Class Assessment, Report, Quiz
	Determination of pH of water	
	Determination Color of water	
2	Determination Turbidity of water	
	Determination TS, TDS, TSS of water	
3	Determination of CO_2	
	Determination of Chloride of Water	
4	Determination of Alkalinity of water	
	Determination of Hardness of water	

5	**Quiz --- 1**	
6	Determination of Biochemical Oxygen Demand (BOD5)	Viva, Class Assessment, Report, Quiz
	Determination of Chemical Oxygen Demand (COD)	
7	Determination of Total Iron of Water	
	Determination of Arsenic contamination of water	
8	Alum Coagulation	
	Determination of Total and Fecal Coliform of water	
9	Break Point Chlorination	
10	Noise survey, data collection and laboratory analysis	
11	Ari quality survey, data collection and laboratory analysis	
12	Review Lectures and Viva/Assessment	-
13	**Quiz --- 2**	-
14	**No class**	

ASSESSMENT STRATEGY

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

REFERENCE BOOKS

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

Fall semester L-4, T-2

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 431 : Natural Resources and Renewable Energy	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course explains about different aspects of natural resources including the classification, depletion, protection and management. In this course, students will be introduced with the various technologies related to sustainable extraction of natural resources and optimum utilization of renewable energy.

OBJECTIVE

- To develop a deep understanding about the classification and importance of natural resources and renewable energy.
- To familiarize with various methods of extraction, depletion, protection and management of natural resources.
- To apply modern technologies to extract and utilize natural resources and renewable energy ensuring a non-declining stream of benefits for all.

COURSE CONTENT

Classification, extraction, depletion, protection and management of natural resources.
Overview, history, mainstream technologies; wind power, hydropower, solar energy, biomass, bio-fuel, geothermal energy, gallery, commercialization, growth of renewable, economic trends, hydroelectricity, wind power development, solar thermal, photovoltaic development, photovoltaic power stations, bio fuel development, geothermal development and emerging technologies of renewable energy.

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	Ability to **understand** various aspects of natural resources and renewable energy including their	√											

	historical importance in the economic development of the country.												
2	Ability to **identify** different resources management techniques and their corresponding impacts on environment.						√						
3	Ability to **apply** various modern technologies for the extraction and protection of natural resources.				√								

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding Pos	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	To **understand** various aspects of natural resources and renewable energy including their historical importance in the economic development of the country.	1	C2	1	-	1	Class Test, Mid-term, Pop quiz, Final Exam
CO2	To **identify** different resources management techniques and their corresponding impacts on environment.	7	C2	2	-	4, 7	Class Test, Mid-term, Pop quiz, Final Exam
CO3	To **apply** various modern technologies for the	5	C3	5	2	6	Assignment, Pop quiz

	extraction, and protection of natural resources.						

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)	28
Guided Learning Tutorial/ Assignments (3 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, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Classification and sources of natural resources	CT/ Final Exam/ Assignment
	2	Extraction techniques of natural resources	
2	3	Depletion and protection of natural resources	
	4	Management techniques of natural resources	
3	5	Impact of management techniques of natural resources	
	6	Overview of history of mainstream technologies related to natural resources	
4	7	Overview of history of mainstream technologies related to natural resources	
	8	Introduction to wind power and hydropower	
5	9	Introduction to wind power and hydropower	

	10	Concept of solar energy, biomass, bio-fuel	
6	11	Concept of solar energy, biomass, bio-fuel	Mid Term Exam/ Final Exam/ Assignment
	12	Introduction to geothermal energy	
7	13	Importance of renewable energy and its corresponding growth	
	14	Importance of renewable energy and its corresponding growth	
8	15	Economic trends of renewable energy and resources	
	16	Economic trends of renewable energy and resources	
9	17	Introduction to hydroelectricity	
	18	Introduction to hydroelectricity	
10	19	Concept of wind power development	
	20	Importance of solar and thermal power development	
11	21	Importance of solar and thermal power development	
	22	Introduction to photovoltaic development	
12	23	Introduction to photovoltaic power stations	CT/ Final Exam/ Assignment-3
	24	Introduction to bio fuel development	
13	25	Introduction to geothermal development	
	26	Emerging technologies of renewable energy	
14	27	Emerging technologies of renewable energy	
	28	Review Class	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3
Final Exam	60%	CO 1	C2
		CO 2	C2
		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS
1. Encyclopedia of Energy, Natural Resource, and Environmental Economics – Jason Shogren (1st Edition) 2. Natural Resources Available Today and in the Future – Erik Dahlquist & Stefan Hellstrand 3. Renewable Energy Resources: Basic Principles and Applications – G.N. Tiwari & M.K. Ghoshal

Fall semester L-4, T-2

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 433 : Solid and Hazardous Waste Management	Lecture contact hours Credit hours	: 2.00 : 2.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
In this course students will be introduced about solid and hazardous waste management and will learn about different aspects of these wastes including their types, sources, properties and various treatment methods. Students will also learn about the integrated solid waste management and life cycle inventory analysis.			
OBJECTIVE			
• To identify the characterization of different kinds of solid and hazardous wastes and their treatment. • To analyze health and environmental issues related to solid waste management. • To solve solid waste and hazardous problem for ensuring public health safety.			
COURSE CONTENT			
Solid Waste Management: sources and types of solid wastes; physical and chemical properties of solid wastes; solid waste generation (Separation at source); on-site handling, storage and processing; collection of solid wastes; transfer stations and transport; resources and energy recovery and recycling (Reduction, Re-used & Recycling- 3R concept); decomposition of solid waste: anaerobic treatment/biogasification, aerobic treatment/composting; thermal treatment, land disposal. Hazardous Waste Management: identification, sources and characteristics of hazardous wastes; different types of hazardous waste, hazardous waste management plant; methods of treatment (physical, chemical, biological and thermal treatment; fixation/stabilization) and disposal (landfill and ocean dumping, engineering storage, incineration and deep burial) of hazardous waste, nuclear waste management. Healthcare waste management, categories of healthcare waste, treatment methods of healthcare waste. Integrated solid waste management and live cycle inventory analysis.			

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	Ability to **identify** various kinds of solid and hazardous wastes and their corresponding treatment methods.		√										
2	Ability to **analyze** health and environmental issues related to solid waste management**.**							√					
3	Ability to **solve** solid waste management-waste reduction at source, collection techniques, materials and resource recovery/recycling, optimization of solid waste transport, treatment and disposal techniques.				√								

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **identify** various kinds of solid and hazardous wastes and their corresponding treatment methods.	2	C2	1	-	1	Assignment, Pop quiz, Final Exam
CO2	Ability to **analyze** health and environmental issues related to solid waste management**.**	7	C4	3	-	7	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **solve** solid waste management-waste reduction at source, collection techniques, materials and resource	4	C3	5	4	6	Class Test, Mid-term, Pop quiz, Final Exam

	recovery/recycling, optimization of solid waste transport, treatment and disposal techniques.						

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, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	**Lecture**	**Topics**	**Assessments**
1	1	Sources and types of solid wastes	CT/ Final Exam/ Assignment
	2	Physical and chemical properties of solid wastes	
2	3	Solid waste generation (Separation at source)	
	4	On-site handling, storage and processing of solid wastes	
3	5	Collection of solid wastes: transfer stations and transport	
	6	Collection of solid wastes: transfer stations and transport	

4	7	Resources and energy recovery and recycling (Reduction, Re-used & Recycling- 3R concept)	
	8	Resources and energy recovery and recycling (Reduction, Re-used & Recycling- 3R concept)	
5	9	Decomposition of solid waste: anaerobic treatment/biogasification,	
	10	Decomposition of solid waste: aerobic treatment/composting;	
6	11	Thermal treatment and land disposal of solid wastes	Mid Term/ Assignment
	12	Identification, sources and characteristics of hazardous wastes	
7	13	Different types of hazardous waste	
	14	Hazardous waste management plant	
8	15	Methods of treatment of hazardous wastes (physical and chemical methods)	
	16	Methods of treatment of hazardous wastes (biological and thermal treatment)	
9	17	Methods of treatment of hazardous wastes (fixation/stabilization)	
	18	Disposal (landfill and ocean dumping) of hazardous waste	
10	19	Disposal (engineering storage, incineration and deep burial) of hazardous waste	
	20	Nuclear waste management	
11	21	Healthcare waste management	
	22	Categories of healthcare waste	
12	23	Treatment methods of healthcare waste	CT/ Final Exam/ Assignment
	24	Treatment methods of healthcare waste	
13	25	Integrated solid waste management	
	26	Integrated solid waste management	
14	27	Live cycle inventory analysis	
	28	Review Class	

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%	CO1	C2
		CO2	C4
		CO3	C3
Total Marks	100%		

REFERENCE BOOKS

1. Solid and Hazardous Waste Management – PM Cherry
2. Solid Waste Management (Principles and Practice) – Ramesha Chandrappa & Diganta Bhusan Das (Springer)
3. Solid and Hazardous Waste Management – M. Habibur Rahman & Abdullah Al-Muyeed (First Edition, ITN-BUET)

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 435 : Environmental Pollution Management	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE
None
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
This is a course where students will be able to know about different reasons and sources of environmental pollution including water and air. Students will be able to learn the air and water pollution control measures and technologies. Theories of dissolved oxygen model, air quality model will be introduced.
OBJECTIVE
• To gain knowledge on the basics of Environmental pollution. • To become skilled at controlling surface, marine and groundwater water pollution • To get acquainted with technologies of controlling air pollution • To devise the theories for developing dissolved oxygen model
COURSE CONTENT
Environmental pollution and its Control; water pollution – sources and types of pollutants; waste assimilation capacity of streams; dissolved oxygen modelling; ecological balance of streams; industrial pollution; heavy metal contamination; detergent pollution and eutrophication; groundwater pollution; marine pollution; pollution control measures: water quality monitoring and management. Concepts of wetlands. Air pollution: sources and types of pollutants; effects of various pollutants on human health, materials and plants; air pollution meteorology; global warming, climate change and ozone layer depletion; air pollution monitoring and control measures; introduction to air quality models.

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	**Analyze** the root cause of water, air and land pollution and also to control such pollution		√										

2	**Apply** different pollution controlling measures for securing public health.							√					

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Analyze** the root cause of water, air and land pollution and also to control such pollution	2	C4	1	1	4	Class Test, Mid-term, Pop quiz, Final Exam
CO2	**Apply** different pollution controlling measures for securing public health	7	C3	3	4	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 (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, Problem Based Learning (PBL)

TEACHING SCHEDULE			
Week	**Lecture**	**Topics**	**Assessment**
1	1	Introduction to Environment, Importance of pollution studies	CT/ Final Exam/ Assignment
	2	Sources of various Env Pollution; water, air, land	
2	3	Water Pollution-Sources and Types of Pollutants	
	4	Surface water pollution; river pollution	
3	5	River pollution around Dhaka City, present scenario	
	6	Causes of river pollution, sewage and industrial water	
4	7	Effects of river water pollution on surrounding Env	CT/ Final Exam/ Assignment
	8	Waste assimilation capacity, Eutrophication	
5	9	Dissolved Oxygen, BOD and COD, BOD example problem	
	10	DO Sag curve, Ecological balance of streams	
6	11	Water Quality Index	Mid Term/ Assignment
	12	Industrial pollution and river water quality	
7	13	Marine Pollution, Groundwater pollution	
	14	Wetland and surface water pollution	
8	15	Introduction to air pollution	
	16	Sources and types of Air pollutants;	
9	17	Effects of various pollutants on human health, materials and plants;	
	18	Air pollution meteorology	
10	19	Air pollution meteorology	
	20	Introduction to air quality models.	
11	21	Air Diffusion Model, Gaussian Plume	
	22	ozone layer depletion; acid rain	CT/ Final Exam/ Assignment
12	23	Air pollution monitoring	
	24	Global warming, climate change	
13	25	Control of air pollution	

	26	Control of air pollution	
14	27	Case Study of Air Pollution	
	28	Review of Air quality Standard and Air Diffusion Model	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2	C3, C4
Final Exam	60%	CO 1	C3
		CO 2	C4
Total Marks	100%		

REFERENCE BOOKS

1. Environmental Engineering-Howard S. Peavy
2. Water Supply, waste disposal and Sanitary Engg., AK Chatterjee
3. Groundwater Hydrology, 3rd Edition, David Keith Todd, Larry W. Mays
4. Principles of Water Treatment, Kerry J. Howe, David W. Hand

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 437 : Climate Change and Disaster Management	Lecture contact hours Credit hours	: 2.00 : 2.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This is a course where students will be able to know about different reasons and sources of environmental hazards. Students will be able to learn the causes of climate change, its impact in human life and nature. Also, theories of vulnerability assessment, disaster management, water scarcity in coastal regions, other agricultural and groundwater problems will be introduced to the students so that it can help them in their professional life to mitigate environmental risks.			
OBJECTIVE			
• To gain knowledge on the basic causes, source and impacts of climate change and related hazards. • To get acquainted with the reasons and mitigation process of climate change. • To apply the concept of disaster preparedness and management.			
COURSE CONTENT			
Brief description of various types, nature, sources, causes and impacts of Environmental hazards experienced in Bangladesh. Cyclones, storm surges, tsunami, flood, salinity intrusion due to sea level rise, water logging and inundation, food insecurity, river bank erosion, river sedimentation problem, extreme droughts, groundwater level depletion, agricultural damages, shortages of fresh water in coastal region, vulnerability assessment, Disaster management, technologies for warning system, role of information in disaster, disaster preparedness. History of natural disaster, Classification of natural disasters, sources of natural disaster, causes and effects of natural disasters.			

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	**Identify** the root cause of environmental hazards and probable reasons of climate change and its impacts on human life.		√										
2	**Understand** the concept of disaster preparedness and management.		√										
3	**Apply** modern technologies for mitigating disaster risk, issuing early warning and initiating rescue operation.					√							

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Identify** the root cause of environmental hazards and probable reasons of climate change and its impacts on human life.	2	C2	1	1	1	Class Test, Mid-term, Pop quiz, Final Exam
CO2	**Understand** the concept of disaster preparedness and management.	2	C2	1	1	7	Class Test, Mid-term, Pop quiz, Final Exam
CO3	**Apply** modern technologies for mitigating disaster risk, issuing early warning and initiating rescue operation.	5	C3	3	4	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 (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, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessment
1	1	Introduction to Climate change and related hazards	CT/ Final Exam/ Assignment
	2	Sources, causes of various Climate related Environmental hazards	
2	3	Impacts of various Environmental hazards	
	4	Introduction to different types of natural disaster	
3	5	Effect and causes of Cyclones, storms surges, flood and salinity intrusion for sea level rise	
	6	Effect and causes of Cyclones, storms surges, flood and salinity intrusion for sea level rise	

4	7	Water logging and inundation, food scarcity	CT/ Final Exam/ Assignment
	8	River bank erosion causes and solution	
5	9	River sedimentation problem and droughts	
	10	Groundwater level depletion and agricultural damages mitigation processes	
6	11	Salinity problem in drinking water in coastal region	Mid Term/ Final Exam/ Assignment
	12	Salinity problem in drinking water in coastal region	
7	13	History of natural disaster and classification	
	14	History of natural disaster and classification	
8	15	Sources and causes of natural disaster	
	16	Sources and causes of natural disaster	
9	17	Effects of natural disaster	
	18	Effects of natural disaster	
10	19	Vulnerability Assessment	
	20	Vulnerability Assessment	
11	21	Disaster management and risk mitigation	
	22	Disaster management and risk mitigation	CT/ Final Exam/ Assignment
12	23	Technologies for warning system	
	24	Technologies for warning system	
13	25	Information role during disaster	
	26	Information role during disaster	
14	27	Disaster preparedness	
	28	Disaster preparedness	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3

Final Exam	60%	CO 1	C2
		CO 2	C3
		CO 3	C2
Total Marks	100%		

REFERENCE BOOKS

1. Environmental Engineering-Howard S. Peavy
2. Water Supply, waste disposal and Sanitary Engg., AK Chatterjee
3. Groundwater Hydrology, 3rd Edition, David Keith Todd, Larry W. Mays
4. Principles of Water Treatment, Kerry J. Howe, David W. Hand

Fall semester L-4, T-2

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 439 : Environmental Impact Assessment and Sustainability	Lecture contact hours Credit hours	: 2.00 : 2.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
The course provides an overview of the concepts, methods, issues and various forms and stages of the EIA process. This course also introduces the methodology of social impact assessment, in this course, students will also be introduced with the concept of sustainability and the corresponding methods of sustainable management of any project.			
OBJECTIVE			
• To understand importance of sustainability, major principles and different steps within environmental impact assessment. • To gain familiarity about social impact assessment and its corresponding objectives and methods in any projects • To apply concept of sustainability and environmental monitoring/management plan to manage social conflicts and reduce environment degradation of any projects			
COURSE CONTENT			
Important terms, aims, objectives, roles and methodology of environmental impact assessment; EIA of development schemes; Economical evaluation of EIA; EIA in water resources and industrial projects; Application of EIA; EIA for protection measures; EIA of : draughts in dry season, rainy season, impact of flood, solid waste management etc. Different EIA index calculation. Social impact assessment (SIA): terms, objectives, social variables and indicators, steps, methodologies, importance. Sustainability, SDG, Methods of Sustainable management.			

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	Ability to **understand** the roles and methodologies of environmental impact	√											

	assessment, social impact assessment and sustainable management of resources.												
2	Ability to **interpret** an EIA or SIA through presenting the conclusions and translating the conclusions in to actions.						√						
3	Ability to **apply** appropriate methods for sustainable management of resources, EIA or SIA depending on the criteria of the situation.							√					

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** the roles and methodologies of environmental impact assessment, social impact assessment and sustainable management of resources.	1	C2	1	-	1	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **interpret** an EIA or SIA through presenting the conclusions and	6	C3	2	-	7	Class Test, Mid-term, Pop quiz, Final Exam

	translating the conclusions into actions.						
CO3	Ability to **apply** appropriate methods for sustainable management of resources, EIA or SIA depending on the criteria of the situation.	7	C3	6	4	6, 7	Assignment, Pop quiz

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

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (3 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 learning) Preparation for tests and examination	22 15
Assessment Continuous Assessment Final examination	2 3
Total	80

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE			
Week	**Lecture**	**Topics**	**Assessments**
1	1	Environmental Issues in Bangladesh and environmental management	CT/ Final Exam/ Assignment
	2	Overview of Policies, laws and Regulatory framework for environmental management in Bangladesh	
2	3	Guidelines and standards for environmental management in Bangladesh	
	4	EIA as a planning tool	
3	5	Steps in EIA process; how to conduct baseline studies	
	6	How to conduct baseline studies in EIA	
4	7	EIA methodologies: impact evaluation	
	8	EIA methodologies: significance of impacts	
5	9	Overview of modelling tools to assess impacts on environment	
	10	Sectoral EIA guidelines	
6	11	Economical evaluation of EIA	Mid Term/ Assignment
	12	Evaluation of EIA system in Bangladesh	
7	13	EIA in water resources and industrial projects	
	14	Application of EIA	
8	15	EIA for protection measures	
	16	Case Study for EIA: droughts in different seasons, impact of flood, solid waste management etc	
9	17	Case Study for EIA: droughts in different seasons, impact of flood, solid waste management etc	
	18	Different EIA index calculation	
10	19	Introduction to social impact assessment (SIA)	
	20	Social variables and indicators for SIA	
11	21	Steps in SIA process	
	22	SIA methodologies and importance	
12	23	SIA methodologies and importance	CT/ Final Exam/ Assignment
	24	Introduction to Sustainability	
13	25	Discussion on SDG	
	26	Discussion on SDG	
14	27	Methods of Sustainable management	
	28	Review Class	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment	40%	CO1, CO2, CO3	C2, C3

(Class assignments/ CT/ Mid Term/ Active Class Participation)			
Final Exam	60%	CO 1, CO 2, CO 3	C2, C3 , C3
Total Marks	100%		

REFERENCE BOOKS

1. Environmental Assessment in Practice (Routledge Environmental Management) – Owen Harrop and Ashley Nixon
2. Methods of Environmental and Social Impact Assessment (Natural and Built Environment Series) – Riki Therivel and Graham Wood (4th Edition)
3. The Age of Sustainable Development – Jeffrey D Sachs and Ki–moon Ban

Fall semester L-4, T-II

Sessional (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 432 : Design of Water Supply, Sanitation and Sewerage Systems	Lecture contact hours Credit hours	: 1.5 : 1.5

PRE-REQUISITE
None
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
This is a design course of water supply and sewerage system: estimation of industrial, domestic and fire demands, designing deep tubewell and water distribution network; estimation of industrial, domestic and commercial wastewater generation, wastewater network design. Students will be able to learn design of water/wastewater network using different software, household plumbing system design; design of water and wastewater treatment plant; computer application in environmental engineering; field visits and reporting, Design of ETP which will be useful in various professional project designing.
OBJECTIVE
• To develop a deep understanding of water supply and sewerage system • To be able to design deep tubewell and distribution network. • To be familiar with different design software. • To design water and wastewater treatment plant. • To design ETP.
COURSE CONTENT
Design of water supply and sewerage system: estimation of industrial, domestic and fire demands, designing deep tubewell and water distribution network; estimation of industrial, domestic and commercial wastewater generation, wastewater network design; design of water/wastewater network using different software; household plumbing system design; design of water and wastewater treatment plant; computer application in environmental engineering; field visits and reporting, Design of ETP.
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	**Use** techniques and modern tools in designing industrial					√							

	waste treatment options for Engineering practice.												
2	D**evelop** solutions for fresh water supply system, waste water discharge, storm water flow in urban as well as rural areas.			√									

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Use** techniques and modern tools in designing industrial waste treatment options for Engineering practice.	5	C3	1	1	6	Quiz + Viva
CO2	**Develop** solutions for fresh water supply system, waste water discharge, storm water flow in urban as well as rural areas.	3	C5	3	3	5	Quiz + Viva

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (3 hours/week x 9 weeks)	27
Guided Learning Report Writing (1 hour/week x 9 weeks)	9
Independent Learning Individual learning Preparation for tests and examination	06 06 06

Site Visit and Groupwork (3 hours/week x 2 weeks)	
Assessment Quiz Presentation + Viva	 3 3
Total	60
TEACHING METHODOLOGY	
Lecture and Discussion, Problem Based Learning (PBL)	
TEACHING SCHEDULE	

Week	Topics	Assessment
1	Introduction to Building	Quiz
2	Floors, Roofs and Stairs	
3	Introduction to Brick Masonry	
4	Plastering, Painting and Pointing	
5	Introduction to Lintels and Arches	Quiz
6	Site Visit	
7	Shoring; Underpinning; Scaffolding and Formwork	
8	Practice	
9	Introduction to Deep and Shallow Foundations	Quiz
10	Introduction to Project Planning and Construction	
11	Plumbing	
12	Practice	
13	Site Visit	
14	----	Presentation + Viva

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Continuous assessment and Quizzes	55%	CO1, CO2	C3, C5
Report writing	35%	CO 1	C3
		CO 2	C5
Viva	10%	CO1, CO2	C3, C5
Total Marks	100%		

REFERENCE BOOKS
1. Waste Water Engineering – Metcaf & Eddy (4^{th} edition)
2. Environmental Engineering – H.S. Peavy, D.R. Rowe, G. Tchobanoglous.
3. Harvesting Rainwater from Buildings – Syed Azizul Haque

5.10 Geotechnical Engineering

Spring semester L-3, T-I

Theoretical (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 341 : Principles of Geotechnical Engineering	Lecture contact hours Credit hours	: 4.00 : 4.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This is the introductory course on geotechnical engineering where students will be oriented with the 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

- To analyze the results of laboratory tests for soil classification and to determine the shear strength parameters, the coefficient of permeability, the consolidation and the compaction characteristics according to the ASTM standards.
- To apply the consolidation and stress distribution theory to predict the consolidation behavior in presence of clay layer beneath the foundations.
- To compute the lateral and vertical forces acting on the retaining structures and foundations.
- To estimate the flow rates and uplift forces due to the seepage within the soil.

COURSE CONTENT
Introduction to geotechnical engineering, Formation, type and identification of soils, Soil composition, Soil structure and fabric, Index properties of soils, Weight volume relationship, Engineering classification of soils, Soil compaction, Principles of total and effective stresses, Permeability and seepage, Stress-strain-strength characteristics of soils, Compressibility and settlement behavior of soils, Lateral earth pressure, Stress distribution

COURSE OUTCOMES AND SKILL MAPPING

No.	COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Ability to **comprehend** the physical and index	√											

	properties of soil and their use in engineering classification.												
2	Ability to **estimate** the distribution of stresses within the soil mass due to overburden, pore water and external loading.		√										
3	Ability to **synthesize** the performance of soil due to consolidation processes.		√										
4	Ability to **comprehend** the physical and index properties of soil and their use in engineering classification.				√								

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **comprehend** the physical and index properties of soil and their use in engineering classification.	1	C2	1, 2	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **estimate** the distribution of stresses within the soil mass due to overburden, pore water and external loading.	2	C4	-	-	-	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **synthesize** the performance of soil due to	2	C4	2	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam

	consolidation processes.						
CO4	Ability to **comprehend** the physical and index properties of soil and their use in engineering classification.	4	C4	5	-	3, 4	Assignment, 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)	56
Guided Learning Tutorial/ Assignments (3 hours/week x 5 weeks)	20
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	48 30
Assessment Continuous Assessment Final examination	3 3
Total	160

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Introduction to geotechnical engineering	CT/ Final Exam/ Assignment
	2	Introduction to geotechnical engineering	
	3	Principles of total and effective stresses	
	4	Principles of total and effective stresses	
2	5	Introduction to geotechnical engineering	
	6	Introduction to geotechnical engineering	

	7	Principles of total and effective stresses	
	8	Principles of total and effective stresses	
3	9	Formation, type and identification of soils	
	10	Formation, type and identification of soils	
	11	Permeability	
	12	Permeability	
4	13	Soil composition	CT/ Final Exam/ Assignment
	14	Soil composition	
	15	Seepage	
	16	Seepage	
5	17	Soil composition	
	18	Soil composition	
	19	Seepage	
	20	Seepage	
6	21	Soil structure and fabric	Mid Term/ Final Exam/ Assignment
	22	Soil structure and fabric	
	23	Stress-strain-strength characteristics of soils	
	24	Stress-strain-strength characteristics of soils	
7	25	Soil structure and fabric	
	26	Soil structure and fabric	
	27	Stress-strain-strength characteristics of soils	
	28	Stress-strain-strength characteristics of soils	
8	29	Index properties of soils	
	30	Index properties of soils	
	31	Compressibility and settlement behaviour of soils	
	32	Compressibility and settlement behaviour of soils	
9	33	Index properties of soils	
	34	Index properties of soils	
	35	Compressibility and settlement behaviour of soils	
	36	Compressibility and settlement behaviour of soils	
10	37	Weight volume relationship	

	38	Weight volume relationship	
	39	Lateral earth pressure	
	40	Lateral earth pressure	
11	41	Weight volume relationship	
	42	Weight volume relationship	
	43	Stress-strain-strength characteristics of soils	
	44	Stress-strain-strength characteristics of soils	
12	45	Engineering classification of soils	CT/ Final Exam/ Assignment
	46	Engineering classification of soils	
	47	Stress-strain-strength characteristics of soils	
	48	Stress-strain-strength characteristics of soils	
13	49	Engineering classification of soils	
	50	Engineering classification of soils	
	51	Stress distribution	
	52	Stress distribution	
14	53	Soil compaction	
	54	Soil compaction	
	55	Stress distribution	
	56	Stress distribution	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C4
Final Exam	60%	CO 1	C2
		CO 2	C4
		CO 3	C4
		CO4	C4

Total Marks	100%		
REFERENCE BOOKS			

1. Principles of Geotechnical Engineering (8th Ed.)-Braja M. Das & Khaled Sobhan.
2. Foundation Engineering (2nd Ed.)-R. B. Peck, W. E. Hanson & T. H. Thornburn.
3. An Introduction to Geotechnical Engineering (2nd Ed.) - R. D. Holtz & William D. Kovacs.
4. Geotechnical Engineering – Principles and Practices (2nd Ed.) - D. P. Coduto.
5. Geotechnical Engg. (2010) – A practical problem-solving approach - N. Siv. and B. M. Das.
6. Soil Mechanics in Engineering Practice (3rd Ed.) - Terzaghi, Peck &Mesri.
7. Craigs Soil Mechanics - R. F. Craig & R. F. Pink.
8. Engineering Soil Mechanics - Jan J. Tuma& M. Abdel-Hady.
9. Elements of Soil Mechanics - Geoffrey Nesbitt Smith.

Fall semester L-3 T-II

Theoretical (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 343 : Foundation Engineering	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To become skilled in exploring subsoil condition and in determining the properties of underlying soil of a site. Students will gain knowledge on the analysis, design and construction of footing, raft and pile foundations in various types of soil conditions. They will also gain insight about analysis and design of natural and man-made soil slopes.			
OBJECTIVE			
• 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. • 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. • 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. • To analyze the performance of existing foundation in various subsoil conditions. • To analyze the stability of any soil slopes in order to determining proper and stable slopes on various subsoil, improved ground and groundwater conditions. • To design new foundation and stable soil slopes on various subsoil, improved ground and various groundwater conditions.			
COURSE CONTENT			
Introduction to foundation engineering, subsoil investigation techniques, types of foundations, bearing capacity of shallow foundations, settlement and distortion of shallow foundations, deep foundations; bearing capacity of pile foundations, design and construction of footings, rafts and piles, slope stability analyses, ground improvements.			

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	Ability to **apprehend** the knowledge of subsoil investigation and to determine the properties of foundation soil in order to design and construct proper types of foundation of any civil engineering structures.	√											
2	Ability to **evaluate** the bearing capacity and settlement for the purpose of designing footing, raft foundations, single and group pile foundation for a structure on various subsoil and loading conditions.		√										
3	Ability to **apprehend** the knowledge of subsoil investigation and to determine the properties of foundation soil in order to design and construct proper types of foundation of any civil engineering structures.			√									

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods

CO1	Ability to **apprehend** the knowledge of subsoil investigation and to determine the properties of foundation soil in order to design and construct proper types of foundation of any civil engineering structures.	1	C1	1, 2	-	4, 5	Pop Quiz, Class Test
CO2	Ability to **evaluate** the bearing capacity and settlement for the purpose of designing footing, raft foundations, single and group pile foundation for a structure on various subsoil and loading conditions.	2	C2, C3	2	-	4, 5	Class Test/ Mid-Term/ Final Exam
CO3	Ability to **apprehend** the knowledge of subsoil investigation and to determine the properties of foundation soil in order to design and construct proper types of foundation of any civil engineering structures.	3	C4, C5	5	-	3, 4	Class test/ Final Exam
WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile							

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face to Face Learning	42

Lecture (3 hours/week x 14 weeks)	
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	Lecture	Topics	Assessments
1	1	Scope and aspects of foundation engineering	CT/ Final Exam/ Assignment
	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.	
	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.	
2	4	Types of boring: Auger boring; Hollow stem auger boring; Wash boring; Percussion boring; ODEX drilling	
	5	Types of boring: Auger boring; Hollow stem auger boring; Wash boring; Percussion boring; ODEX drilling	
	6	Bearing capacity of strip footing on cohesionless soil; Effect of footing shapes on bearing capacity;	
3	7	Determination of ground water table; Soil sampling techniques.	

	8	Penetration tests; Standard penetration test and SPT N-values; Corrections for SPT N-values; SPT and soil strength parameters.	
	9	Design charts for the design of footing on cohesionless soil.	
4	10	Types of soil samplers; Types of soil samples and their usages; Sample disturbance and its measurement; Rock quality designation	CT/ Final Exam/ Assignment
	11	Dynamic cone penetration test; Dutch cone penetration (CPT); Cone and sleeve resistance.	
	12	Bearing capacity of footing on clay; Skempton's equation.	
5	13	CPT friction ratio and its relationship with soil types; Use of piezocone in determining porewater pressure and water table; CPT-SPT relations.	
	14	Geophysical methods of subsoil investigation; Field vane shear test; Subsoil investigation report.	
	15	Effect of load eccentricity on bearing capacity; Meyerhof concept of equivalent footing width.	
6	16	Types of deep foundation; Classification and use of pile foundation.	Mid Term/ Final Exam/ Assignment
	17	Driven and bored piles; Friction and bearing piles; Analysis of skin friction and end bearing for driven piles in sand.	
	18	Bearing capacity of raft foundation; Factor of safety in bearing capacity.	
7	19	Critical depth concept for piles in cohesionless soil; Estimation of skin friction and end bearing using critical depth concept.	
	20	Computation of skin friction of driven piles in clay; α-method.	
	21	Construction problems of footing and raft foundation.	
8	22	Computation of skin friction of driven piles in clay; β-method; λ-method.	
	23	End bearing for piles in clay soil; Bearing capacity of group piles in sand and clay; Efficiency of pile group.	

	24	Computation of settlement of footing; Elastic settlement; immediate settlement and consolidation settlement.	
9	25	Effect of load eccentricity on group piles; Estimation of bearing capacity from SPT-value for piles in sand, clay and silty soil.	
	26	Pile driving formula; Uplift capacity of individual pile and group.	
	27	Construction problems of driven piles.	
10	28	Negative skin friction and remedial measures. Bearing capacity of bored piles;	
	29	Pile load test and interpretation of load test data.	
	30	Construction problems of bored piles; Methods of advancing holes.	
11	31	Introduction to stability of slopes; Analysis of infinite slopes of cohesionless, cohesive and c-φ soils.	
	32	Planner method of stability analysis of finite slopes; Culmann’s analysis;	
	33	Properties of bentonite to be used in advancing boreholes for cast in situ piles; Limitations of bentonite method	
12	34	Effect of submergence and seepage on stability of infinite slopes.	CT/ Final Exam/ Assignment
	35	Different modes of circular finite slope failure; Mass method of stability of slopes.	
	36	Actions to be taken before concreting of bored piles; Concreting of bored piles; Reverse circulation method	
13	37	Slices methods of stability of slopes; Ordinary method of slices;	
	38	Various methods of determining centre or locus of slip surface.	
	39	Ground Improvement Methods Soil Stabilization and Preloading	
14	40	Simplified Bishop method of stability analysis	
	41	Taylor’s chart.in analyzing stability of slopes.	
	42	Ground Improvement Methods SCP and Stone Columns	

<table>
<tr><th colspan="4">ASSESSMENT STRATEGY</th></tr>
<tr><th>Components</th><th>Grading</th><th>CO</th><th>Blooms Taxonomy</th></tr>
<tr><td>Continuous Assessment
(Class assignments/ CT/ Mid Term/ Active Class Participation)</td><td>40%</td><td>CO1, CO2, CO3</td><td>C2, C2, C3 & C4</td></tr>
<tr><td rowspan="3">Final Exam</td><td rowspan="3">60%</td><td>CO 1</td><td>C1</td></tr>
<tr><td>CO 2</td><td>C2 & C3</td></tr>
<tr><td>CO 3</td><td>C4 & C5</td></tr>
<tr><td>Total Marks</td><td>100%</td><td></td><td></td></tr>
</table>

REFERENCE BOOKS

1. Principles Foundation Engineering (8th Ed.) - Braja M Das
2. Foundation Engineering (2nd Ed.) - R B. Peck, WE. Hanson & T. H. Thornburn
3. Foundation Design: Principles and Practices - D. P. Coduto
4. Soil Mechanics and Foundation Engineering – B.N.D. Narasinga Rao
5. Foundation Engineering – P.C. Varghese
6. Foundation Analysis and Design - Joseph E. Bowles
7. Bangladesh National Building Code (BNBC), Latest Available Edition

Spring semester L-3, T-I

Sessional (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 342 : Geotechnical Engineering Sessional	Lecture contact hours Credit hours	: 3.00 : 1.50

PRE-REQUISITE
None
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
In this geotechnical engineering laboratory 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
• To determine various properties of soil like index properties, compressibility, and pressure exists in soil, strain-stress characteristics using standard equipment. • To analyze the performance of soil under compaction, consolidation, seepage etc.
COURSE CONTENT
Field identification tests of soils, Grain size analysis by sieve and hydrometer, Specific gravity test, Atterberg limits test, Permeability tests, Unconfined compression test, Compaction test, Relative density test, Direct shear tests, Consolidation tests
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	Ability to **determine** various properties of soil like index properties, compressibility and pressure exists in soil, strain-stress characteristics using standard equipment.	√											

2	Ability to **analyze** the performance of soil under compaction, consolidation, seepage etc.		√										

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **determine** various properties of soil like index properties, compressibility and pressure exists in soil, strain-stress characteristics using standard equipment	1	C1	1, 2	-	4, 5	Class Assessment, Lab Report, Mid Quiz, Final Quiz
CO2	Ability to **analyze** the performance of soil under compaction, consolidation, seepage etc.	2	C4	2	-	4, 5	Class Assessment, Lab Report, Mid Quiz, Final Quiz, Viva
WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile							

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (3 hours/week x 14 weeks)	33
Guided Learning Tutorial/ Assignments (3 hours/week x 5 weeks)	10

Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	8 4
Assessment Continuous Assessment Final examination	2 3
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Experiments

TEACHING SCHEDULE

Week	Topics	Assessments
1	Field identification tests of soils	Lab Report/Class Assessment
2	Specific gravity test	
3	Relative density test	
4	Grain size analysis by sieve and hydrometer	Lab Report/Class Assessment
5	Atterberg limits test	
6	Permeability tests	Lab Report/Class Assessment/Mid Quiz
7	Quiz 01	
8	Compaction test	
9	Unconfined compression test	
10	Direct shear tests	
11	Consolidation tests	
12	Consolidation tests	Lab Report/Class Assessment/ Final Quiz
13	Quiz 02	

14	Viva	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Lab report, Class Assessment)	40%	CO1, CO2	C1, C4
Quiz	60%	CO 1	C1
		CO 2	C4
Total Marks	100%		

REFERENCE BOOKS

1. Soil Testing for Engineers –T W Lambe
2. Soil mechanics laboratory manual – B M Das
3. Engineering properties of soils and their measurement – J E Bowles
4. Manual of Soil Testing – K H Head

Fall semester L-4, T-2

Theoretical (Elective)

COURSE INFORMATION			
Course Code	: CE 443	Lecture contact hours	: 2.00
Course Title	: Earth Retaining Structures	Credit hours	: 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

In this course students will get familiarize with the various types of earth retaining structures and their specific usages. They will also be able to analyze and design different types of earth retaining structures as well as bracing systems for deep excavation.

OBJECTIVE

- To be able to analyze and design both rigid flexible types of earth retaining structures for deep and shallow difference in elevations
- To be able to analyze and design bracing systems for deep excavation.
- To be able to design dewatering system for deep and shallow excavations.

COURSE CONTENT

Foundations of Structures Subjected to Lateral Loads; Rigid and Flexible Earth Retaining Structures; Deep Excavation and Dewatering Methods; Braced Excavation; Sheet Piles, Contiguous Wall, Cofferdams, Caissons and Slurry Walls; Construction Problems in Excavation and Earth Retaining Structures. Use of Plaxis/ Abaqus/ FLAC/GeoStudio/Geo5 to solve basic and complex boundary problems.

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	Ability to **analyze** and **design** earth retaining structures.		√	√									
2	Ability to **analyze** and **design** bracing system for deep excavation.		√	√									

3.	Ability to **comprehend** construction details of structures like slurry wall, cofferdam and caisson.	√											

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **analyze** and **design** earth retaining structures.	2,3	C3/C4	1, 2	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **analyze** and **design** bracing system for deep excavation.	2,3	C3/C4	1.2	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **comprehend** construction details of structures like slurry wall, cofferdam and caisson.	1	C2/C3	1,2	-	4	Class Test, Mid-term, Pop quiz, Final Exam

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

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 learning) Preparation for tests and examination	24 13

Assessment Continuous Assessment Final examination	 2 3
Total	80
TEACHING METHODOLOGY	
Lecture and Discussion, Problem Based Learning (PBL)	
TEACHING SCHEDULE	

Week	Topics	Assessments
1	Rigid and Flexible Earth Retaining Structures;	CT/ Assignment
	Rigid and Flexible Earth Retaining Structures;	
2	Rigid and Flexible Earth Retaining Structures;	
	Rigid and Flexible Earth Retaining Structures;	
3	Sheet Piles	
	Sheet Piles	
4	Sheet Piles	CT/ Final Exam/ Assignment
	Sheet Piles	
5	Braced Excavation	
	Braced Excavation	
6	Braced Excavation	Mid Term/ Final Exam/ Assignment
	Braced Excavation	
7	Deep Excavation and Dewatering Methods	
	Deep Excavation and Dewatering Methods	
8	Deep Excavation and Dewatering Methods	
	Deep Excavation and Dewatering Methods	
9	Contiguous Wall, Cofferdams,	
	Contiguous Wall, Cofferdams,	
10	Caissons and Slurry Walls	
	Caissons and Slurry Walls	
11	Caissons and Slurry Walls	
	Caissons and Slurry Walls	
12	Construction Problems in Excavation and Earth Retaining Structures.	

	Construction Problems in Excavation and Earth Retaining Structures.	CT/ Final Exam/ Assignment
13	Construction Problems in Excavation and Earth Retaining Structures.	
	Use of Plaxis/ Abaqus/ FLAC/GeoStudio/Geo5 to solve basic and complex boundary problems.	
14	Use of Plaxis/ Abaqus/ FLAC/GeoStudio/Geo5 to solve basic and complex boundary problems.	
	Use of Plaxis/ Abaqus/ FLAC/GeoStudio/Geo5 to solve basic and complex boundary problems.	

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. Foundation Engineering: Peck, Hansan and Thornburn
2. Foundations and Earth Retaining Structures: SI Edition –Muni Budhu

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION

Course Code Course Title	: CE 445 : Elementary Soil Dynamics	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

It is a course for soil dynamics where students will learn about dynamic properties of soil, seismic response of soil, soil liquefactions etc. which will be useful in various projects in the later semesters and in their professional life.

OBJECTIVE

- To comprehend the fundamental knowledge on vibration theory for different free and forced vibration system
- To apply the knowledge of site amplification for assimilating the wave propagation effect
- To be able to analyze a machine foundation system for its different characterizing factors

COURSE CONTENT

Elementary Vibrations; Dynamic Properties of Soil; Seismic Response of Soil; Seismic Site Characterization and Site Amplification; Soil Liquefaction; Earthquake Hazards and Remedial Measures, Dynamic Bearing Capacity Analyses, Principles of Machine Foundations.

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	Ability to **comprehend** the fundamental knowledge on vibration theory for different free and forced vibration system.	√											
2	Ability to **analyze** a machine foundation system for its different characterizing factors		√										

3.	Ability to **investigate** the seismic response of soil.				√								

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **comprehend** the fundamental knowledge on vibration theory for different free and forced vibration system.	1	C3/C4	1, 2		4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **analyze** a machine foundation system for its different characterizing factors.	2	C4	1.2		4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **investigate** the seismic response of soil.	4	C3/C4	1,2		4	Class Test, Mid-term, Pop quiz, Final Exam

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

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 learning) Preparation for tests and examination	24 13
Assessment Continuous Assessment Final examination	2 3
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Assessments
1	Dynamic Properties of Soil	CT/ Final Exam/Assignment
	Dynamic Properties of Soil	
2	Dynamic Properties of Soil	
	Dynamic Properties of Soil	
3	Elementary Vibrations	
	Elementary Vibrations;	
4	Seismic Response of Soil	CT/ Final Exam/ Assignment
	Seismic Response of Soil	
5	Seismic Site Characterization and Site Amplification	
	Seismic Site Characterization and Site Amplification	
6	Dynamic Bearing Capacity Analyses	Mid Term/ Final Exam/ Assignment
	Dynamic Bearing Capacity Analyses	
7	Dynamic Bearing Capacity Analyses	
	Dynamic Bearing Capacity Analyses	
8	Dynamic Bearing Capacity Analyses	
	Dynamic Bearing Capacity Analyses	
9	Soil Liquefaction	
	Soil Liquefaction	

10	Soil Liquefaction	
	Soil Liquefaction	
11	Principles of Machine Foundations.	
	Principles of Machine Foundations.	
12	Principles of Machine Foundations.	CT/ Final Exam/ Assignment
	Principles of Machine Foundations.	
13	Principles of Machine Foundations.	
	Principles of Machine Foundations.	
14	Earthquake Hazards and Remedial Measures	
	Earthquake Hazards and Remedial Measures	

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. Principles of Soil Dynamics by Braja M Das and G. V. Ramana
2. Soil Dynamics with Applications in Vibration and Earthquake Protection by Christos Vrettos.
3. An Introduction to Soil Dynamics (Theory and Applications of Transport in Porous Media) by Arnold Verruijt.
4. An Introduction to Soil Dynamics – S Prakash

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 447 : Soil-water Interaction	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE
CE 341, CE 441

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This course will help students to understand the soil properties for the design of foundation, especially to learn how to understand permeability and seepage behavior of soil, capillary action, soil suction for proper design. In this course, students will also be introduced with the concept of slope stability subjected to wave current, design geotechnical landfill for slope stability which will be very useful in their professional life.

OBJECTIVE

- To explore nature of soil when embedded in water in order to design foundation.
- To discern permeability and seepage, capillary action, soil suction for proper design
- To analyze slope stability subjected to wave current, lateral load in order to make river side embankment
- To design geotechnical landfill for slope stability

COURSE CONTENT
Water in Soil: Occurrence and Effects; Soil Water Interaction Problems; Vertical and Horizontal Permeability for homogeneous and stratified soil; Seepage, Capillary and Soil Suction; One Dimensional Flow in Layered Soil; Flow through Earth Dams; Slopes Subjected to Seepage, Water Current, Wave Action etc.; Filters and Revetments; Leachate due to Sanitary Landfill.

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	Ability to **design** geotechnical landfill for slope stability.			√									
2			√										

	Ability to **analyze** slope stability subjected to wave current, lateral load in order to make river side embankment.												
3	Ability to discern and provide **conclusion** for the proper design of foundations after understanding the permeability and seepage, capillary action, soil suction.				√								

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **design** geotechnical landfill for slope stability.	3	C3/C4	1, 2	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **analyze** slope stability subjected to wave current, lateral load in order to make river side embankment.	2	C4	2	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to discern and provide **conclusion** for the proper design of foundations after understanding the permeability and seepage, capillary action, soil suction.	4	C3/C5	5	-	3, 4	Assignment, Pop quiz
WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile							

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 Continuous Assessment Final examination	2 3
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Assessments
1	Water in soil:	CT/ Final Exam/ Assignment-1
2	Occurrence and effects	
3	Soil water interaction problems	
4	Soil water interaction problems	Mid Term/ Final Exam/ Assignment-2
5	Vertical and horizontal permeability for homogeneous and stratified soil	
6	Vertical and horizontal permeability for homogeneous and stratified soil	
7	Seepage	
8	Seepage	
9	Capillary and soil suction;	
10	One dimensional flow in layered soil	
11	Flow through earth dams	
12	Slopes subjected to seepage	CT/ Final Exam/ Assignment-3
13	Water current, wave action	

14	Filters and revetments; leachate due to sanitary landfill	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C3, C4, C5
Final Exam	60%	CO 1	C3, C4
		CO 2	C4
		CO 3	C3, C5
Total Marks	100%		

REFERENCE BOOKS

1. Seepage, Drainage, and Flow Nets by Harry R. Cedergren
2. Earth and earth-rock dams: engineering problems of design and construction by James L. Sherard.
3. Advanced Soil Mechanics (Third edition or later) by Braja M.Das.
4. Soil Mechanics and Foundations by Parcher and Means
5. BWDB Design Manual- May 2010

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION

Course Code Course Title	: CE 449 : Numerical Methods in Geotechnics	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE

CE 341, CE 441

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course will help students to understand the concept of Tensor Analyses, Stresses, Strains. In this course, students will also be introduced with the different material models which will help the students to solve the problems by finite element method, an essential tool for the designers to design any geotechnical structure nowadays.

OBJECTIVE

- To understand Tensor Analyses, stresses, and strains.
- To identify Failure and Plastic Flow, Dilatancy, Yielding and Hardening, Preconsolidation of soil.
- To understand material models and solve geotechnical problems by finite element method.

COURSE CONTENT

Introduction to Tensor Analyses, Stresses, Strains, Equation of Continuum Mechanics, Isotropic Elasticity, Anisotropy, Stress Dependency, Nonlinearity, Failure and Plastic Flow, Dilatancy, Yielding and Hardening, Preconsolidation, Material Models, Critical State, Rate Dependency, Finite Elements, Finite Difference.

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	Ability to **understand** Tensor Analyses, stresses, and strains.	√											
2			√										

	Ability to **identify** Failure and Plastic Flow, Dilatancy, Yielding and Hardening, preconsolidation of soil.												
3	Ability to **understand** material models and **solve** geotechnical problems by finite element method.		√			√							

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes (CO)	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **understand** Tensor Analyses, stresses, and strains.	1	C2	1, 2	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **identify** Failure and Plastic Flow, Dilatancy, Yielding and Hardening, preconsolidation of soil.	2	C2/C5	2	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **understand** material models and **solve** geotechnical problems by finite element method.	2,5	C2/C6	3	-	3, 4	Assignment, Pop quiz

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

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	28 14
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	Lecture	Topics	Assessments
1	1	Introduction to Tensor Analyses, Stresses, Strains	CT/ Final Exam/ Assignment
	2	Introduction to Tensor Analyses, Stresses, Strains	
2	3	Introduction to Tensor Analyses, Stresses, Strains	
	4	Equation of Continuum Mechanics	
3	5	Equation of Continuum Mechanics	
	6	Isotropic Elasticity, Anisotropy	
4	7	Isotropic Elasticity, Anisotropy	Mid Term/ Final Exam/ Assignment
	8	Isotropic Elasticity, Anisotropy	
5	9	Stress Dependency, Nonlinearity	
	10	Stress Dependency, Nonlinearity	
6	11	Stress Dependency, Nonlinearity	

	12	Failure and Plastic Flow, Dilatancy, Yielding and Hardening	
7	13	Failure and Plastic Flow, Dilatancy, Yielding and Hardening	
	14	Failure and Plastic Flow, Dilatancy, Yielding and Hardening	
8	15	Failure and Plastic Flow, Dilatancy, Yielding and Hardening	
	16	Preconsolidation	
9	17	Material Models	
	18	Material Models	
10	19	Material Models	
	20	Critical State	
11	21	Critical State	
	22	Rate Dependency	
12	23	Rate Dependency	CT/ Final Exam/ Asignment
	24	Finite Elements, Finite Difference	
13	25	Finite Elements, Finite Difference	
	26	Finite Elements, Finite Difference	
14	27	Finite Elements, Finite Difference	
	28	Finite Elements, Finite Difference	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2	C2, C5
Final Exam	60%	CO 1	C2
		CO 2	C2, C5
		CO 3	C2, C6

Total Marks	100%		
REFERENCE BOOKS			
1. Constitutive Modelling in Geomechanics -A Puzrin 2. Applied Soil Mechanics with Abaqus applications – S Halwany 3. Plasticity and Geotechnics- Hai Sui Yu 4. Soil Consitutive Models- Evaluation, Selection & Calibration by J A Yammuro & V N Kaliakin			

Fall semester L-4, T-II

Sessional (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 442 : Foundation Design Sessional	Lecture contact hours Credit hours	: 3.00 : 1.5

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This course will help students to interpret data of subsoil investigation report. In this course, students will also be introduced with the geotechnical and structural design of footing, Raft and Piles, which will help the students in their professional life immensely. Besides, students will be introduced with the different geotechnical software's in this course and will be able to analyze a foundation in finite element method.

OBJECTIVE

- To explore types of foundation used for structures based on bearing capacity of soil
- To evaluate the bearing capacity and settlement for the purpose of designing footing, raft, and pile foundations for a structure on various subsoil and loading conditions.
- To analyse the performance of existing foundation and construct new footing, raft, and pile foundation in various subsoil conditions
- To produce lab report with proper results, discussions and conclusion

COURSE CONTENT
Examination and Interpretation of Subsoil Investigation Report; Geotechnical Design of Footing, Raft and Piles; Structural Design of Reinforced Concrete Footing, Raft and Piles; Design of Earth Retaining Structures for Deep Excavations; Design of Reinforced Soil; Use of Foundation Engineering Software

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	Ability to **explore** types of foundation used for structures based on bearing capacity of soil.	√											
2			√										

	Ability to **evaluate** the bearing capacity and settlement for the purpose of designing footing, raft, and pile foundations for a structure on various subsoil and loading conditions.												
3	Ability to **analyze** the performance of existing foundation and construct new footing, raft, and pile foundation in various subsoil conditions.		√										

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **explore** types of foundation used for structures based on bearing capacity of soil.	1	C2/C5	1, 2	-	4, 5	Assignment,Quiz
CO2	Ability to **evaluate** the bearing capacity and settlement for the purpose of designing footing, raft, and pile foundations for a structure on various subsoil and loading conditions.	2	C5/C6	2	-	4, 5	Assignment,Quiz

CO3	Ability to **analyze** the performance of existing foundation and construct new footing, raft, and pile foundation in various subsoil conditions .	2	C4	3	-	3, 4	Assignment,Quiz

WP= Washington Accord Complex Problem Solving/ CP= Complex Problem Solving; EA= Engineering Activities/ CA= Complex Activities; WK= Washington Accord Knowledge Profile/ KP= Knowledge Profile	
TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (3 hours/week x 14 weeks)	42
Guided Learning Assignments (3 hours/week x 5 weeks)	7
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning)	7
Assessment Continuous Assessment Quiz	 3 1
Total	60
TEACHING METHODOLOGY	
Lecture and Discussion, Problem Based Learning (PBL)	
TEACHING SCHEDULE	

Weeks	**Topics**	**Assessments**
1	Interpretation of soil report and shallow foundation bearing capacity calculation by hand and spreadsheet	Assignments and Quiz
2	Interpretation of soil report and shallow foundation bearing capacity calculation by hand and spreadsheet	
3	Structural design of an isolated column footing	

4	Structural design of a combined footing	
5	Bearing capacity and settlement calculation of shallow by Software	
6	Bearing capacity and settlement calculation of shallow by Software	
7	Bearing capacity of single pile, calculation of pile group efficiency.	Assignments and Quiz
8	Bearing capacity of single pile, calculation of pile group efficiency.	
9	Structural design of pile and pile cap	
10	Bearing capacity and settlement calculation of pile and pile group by Software	
11	Bearing capacity and settlement calculation of Raft including structural design	
12	Introduction to plate load test, pile load test, PIT and PDA. Pile construction n methods	
13	Introduction to plate load test, pile load test, PIT and PDA. Pile construction methods	
14	Design of Reinforced Soil	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ Active Class Participation)	40%	CO1, CO2, CO3, CO3,	C2, C4, C5, C6
Quiz	60%	CO 1	C2, C5
		CO 2	C5, C6
		CO 3	C4
Total Marks	100%		

REFERENCE BOOKS

1. Foundation Engineering: R.B. Peck, W.E. Hanson and T.H. Thornburn
2. Principles of Foundation Engineering: SI Edition - B.M. Das

5.11 Transportation Engineering

Spring semester L-4, T-I

Theoretical (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 351 : Fundamentals of Transportation Engineering	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
It's an introductory course of transportation engineering. Students will be oriented with different types of transportation systems, modes, components of geometric design and traffic engineering. After this course students are expected to determine different geometric features of the highway, conduct volume & speed study, install traffic control device and identify components of transportation system.			
OBJECTIVE			
• To understand transportation system, hierarchies, components, modes and classification of road. • To acquire knowledge on geometric design of highways. • To comprehend highway capacity and level of service. • To orient with the transportation system in Bangladesh • To orient with road traffic systems including fundamentals of traffic engineering. • To understand basics of transport planning. • To get acquainted with Intelligent Transportation System (ITS) and Traffic Impact Assessment (TIA).			
COURSE CONTENT			
Transportation engineering, transportation functions; transportation systems, functional components, factors in transportation development, transportation modes, public transportation, emerging modes; transport planning: concepts, scope and hierarchy, process, goals and objectives, inventories, socio-economic activities, land use-transport interaction, travel demand forecasting; transportation in Bangladesh: transportation modes and networks, constraints and challenges, transport demand and modal share, road classification and design standards. Geometric design of highways: design controls and criteria, cross sectional elements, alignment, sight distance, intersection and interchange layouts and design, planning and design of bicycle and pedestrian facilities; highway capacity and level of service: Introduction to road safety issues.			

Traffic engineering: fundamentals of traffic engineering, vehicle and traffic characteristics, traffic control devices and systems, traffic studies, planning and design of parking facilities, roadway lighting; traffic impact assessment (TIA), Introduction to Intelligent Transportation, Fundamentals of transport economics.

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	**Identify** different geometric features of highways including solutions to common geometric challenges.	√											
2	**Demonstrate** knowledge of fundamentals of transportation engineering.	√											
3	**Describe** different transportation systems, functions, different modes, ITS and transportation scenario in Bangladesh.		√										
4	**Recognize** the rudiments of traffic engineering, transportation planning, **design** traffic control devices and street lighting.			√									

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Identify** different geometric features of highways including solutions to common geometric challenges.	1	C1/C2	1, 2	-	4	Pop Quiz, CT, Mid and Final exam
CO2	**Demonstrate** knowledge of fundamentals of transportation engineering.	1	C1/C2	3	-	4, 5	Pop quiz, CT, Mid and Final Exam
CO3	**Describe** different transportation systems, functions, different modes, ITS and transportation scenario in Bangladesh.	2	C1/C2	1	-	3, 4	CT, Mid and Final exam
CO4	**Recognize** the rudiments of traffic engineering, transportation planning, **design** traffic control devices and street lighting.	3	C2/C3/C4	1,2	-	4	CT, Mid and 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	32 25
Assessment Continuous Assessment Final examination	3 3
Total	120
TEACHING METHODOLOGY	
Lecture and Discussion, Problem Based Learning (PBL)	
TEACHING SCHEDULE	

Week	Lecture	Topics	Assessments
1	1	Introduction to Course, Highway classification	CT/ Assignment/ Final Exam
	2	Vehicle and Traffic Characteristics	
	3	/ Transportation’s Place & functions	
2	4	Vehicle and Traffic Characteristics, Braking Distance	
	5	Driver Characteristics	
	6	Transportation Systems	
3	7	Elements of Design: Sight Distance	
	8	SSD on Horizontal and Vertical curve	
	9	Emerging Transportation Technologies and Functional Components	
4	10	Superelevation	

	11	Cross Sectional Element	CT/ Assignment/ Final Exam
	12	/ Factors in transportation development	
5	13	Intersection	
	14	Intersection	
	15	/ Transportation modes	
6	16	Introduction to Traffic Engineering and Traffic Flow parameters	Mid Term/ Assignment/ Final Exam
	17	Traffic Volume Study	
	18	/ Public transportation	
7	19	Traffic Volume Study	
	20	Speed and Delay Study	
	21	Emerging modes	
8	22	Speed and delay Study	
	23	OD survey	
	24	Land use-transport interaction	
9	25	Parking Study	
	26	Traffic Control Device	
	27	Transportation modes and networks - Bangladesh	
10	28	Traffic Sign and Marking	
	29	Terminals	
	30	Constraints/Challenges and Plans for Development-Bangladesh	
11	31	Traffic Signal	
	32	Traffic Signal	
	33	/Challenges and Plans for Development-Bangladesh	
12	34	Street Lighting	CT/ Assignment/ Final Exam
	35	Traffic Impact Assessment	
	36	/ Road classification and Design standards-Bangladesh	

13	37	Traffic Accident	
	38	Revision	
	39	Road classification and Design standards-Bangladesh	
14	40	Road classification and Design standards-Bangladesh	
	41	The transportation planning process	
	42	The transportation planning process	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C3, C4, C5
Final Exam	60%	CO 1 CO 2 CO 3 CO4	C1, C2 C4, C5 C2, C3 C2
Total Marks	100%		

REFERENCE BOOKS

1. "Highway Engineering" by – Paul H. Wright (7th Edition)
2. "Transportation Engineering and Transport Planning" by – L.R. Kadiyali
3. "Transportation Planning and Traffic Engineering" by – O'Flaherty.
4. "A Policy on Geometric Design of Highways and Streets", American Association of State Highways and Transportation Officials, Washington, D. C., 2001.
5. "Traffic and Highway Engineering", - N. J. Garber and L. A. Hoel, West Publishing Company, MN, 2010.
6. "Highway capacity manual", transportation research reports, national research council, Washington D.C., 2000.
7. "Introduction to Transportation Engineering", by - Tom V. Mathew and K V Krishna Rao, NPTEL May 24, 2006
8. " Transportation Engineering and Planning" by- C. S. Papacostas
9. "Introduction to Transportation Engineering" by James H. Bakes
10. "Principles of Highway Engineering and Traffic Analysis" by - Fred L. Mannering
11. "Traffic Engineering Design" by - Mike Slin and others

12. “Transportation Engineering: An Introduction” by- C. John Khisty and B. Kent Lall (3rd edition)
13. Strategic Transport Plan and revised Strategic Transport Plan
14. Geometric Design Standard for Roads and Highways department Government of Bangladesh

Spring semester L-4, T-I

Theoretical (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 451 : Highway Materials, Pavement Design and Railway	Lecture contact hours Credit hours	: 4.00 : 4.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
It's a fundamental course of transportation engineering. Students will be oriented with different types of materials for road construction, pavement types including their design and rudiments of railways. After this course students are expected to identify the required type of pavement, fix its dimensions and select appropriate materials for construction. Besides students will also be able to find out the general requirements of railway.

OBJECTIVE

- To familiarize with the properties, test procedures, specifications and uses of various types of pavement materials including mix design methods.
- To acquire knowledge on characteristics, functions and types of pavement including latest development.
- To acquaint with the different design methods of rigid and flexible pavement.
- To have clear idea about road maintenance and construction equipment.
- To familiarize with low-cost road.
- Learning the basic knowledge on railway engineering, rolling stocks and tracks, signalling, stations and yard.

COURSE CONTENT
Pavement materials: bituminous binders, cement, aggregates, embankment material, soil stabilization; mix design methods; low cost roads; road tests, pavement types, components and functions, fundamentals of flexible and rigid pavement: pavement stresses, traffic and loading, pavement design and construction, pavement distresses and road maintenance; pavement management, railway engineering: general requirements, rolling stock and tracks, stations and yards, points and crossings, signalling, maintenance operations, pavement construction equipment and uses.

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	Able to **demonstrate** various types of pavement, their development, components, functions and maintenance.	√											
2	Able to **design** flexible and rigid pavements using various standard methods.			√									
3	Able to **illustrate** the properties and **select** appropriate road construction materials **and estimate** optimum bituminous content by mix design method.	√											
4	Able to **outline** rudiments of railway.		√										

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Able to **demonstrate** various types of pavement, their components & functions including material requirement.	1	C1/C2	1, 2	-	4	Pop Quiz, CT, Mid and Final exam
CO2	Able to **design** flexible and rigid pavements using	3	C4/C5	3	-	4, 5	CT, Mid and Final Exam

	various standard methods.						
CO3	Able to **illustrate** the properties and **select** appropriate road construction materials. **Estimate** optimum bituminous content by mix design method.	1	C2/C3	1	-	3, 4	Pop Quiz, CT, Mid- and Final Exam
CO4	Able to **outline** rail traffic management, signalling system.	2	C2	1,2	-	4	CT, mid and 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)	56
Guided Learning Tutorial/ Assignments (3 hours/week x 5 weeks)	20
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	48 30
Assessment Continuous Assessment Final examination	3 3
Total	160

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Pavement: definition, Types, Characteristics, functions, layers, comparison of different types of pavement, ME design Method.	CT/ Assignment/ Final Exam
	2	Introduction to Railway Engineering	
	3	Bituminous Materials	
2	4	Pavement: definition, Types, Characteristics, functions, layers, comparison of different types of pavement, ME design Method.	
	5	Introduction to Railway Engineering	
	6	Properties of Bitumen	
3	7	Pavement Design Requirement	
	8	Introduction to Railway Engineering	
	9	Tests of Asphaltic Materials	
4	10	Road Test	CT/ Assignment/ Final Exam
	11	Stress and strain in pavement	
	12	Rail and Sleeper	
5	13	Stress and strain in pavement	
	14	Ballast, Formation and Embankment	
	15	Tests of Asphaltic Materials	
6	16	Joints in Pavement	Mid Term/ Assignment/ Final Exam
	17	Material Characterization	
	18	Aggregates	
7	19	Road maintenance	
	20	Geometric Design of Tracks	
	21	Mix Design	
8	22	Design of Flexible pavement by AASHTO & Asphalt Institute Method	
	23	Points and Crossing	
	24	Mix Design	
9	25	Design of Rigid pavement by AASHTO Method	
	26	Rail Traffic Management	

	27	Mix Design	
10	28	RHD Design Method	
	29	rolling stock and tracks	
	30	Soil	
11	31	PCA design Method	
	32	stations and yards	
	33	Embankment Materials	
12	34	Low-Cost Road	CT/ Assignment/ Final Exam
	35	Railway Signalling	
	36	Cement	
13	37	Road Note 31	
	38	Maintenance operations	
	39	Soil Stabilization	
14	40	Construction Equipment	
	41	Soil Stabilization	
	42	Pavement: definition, Types, Characteristics, functions, layers, comparison of different types of pavement, ME design Method.	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C3, C4, C5
Final Exam	60%	CO 1	C1, C2
		CO 2	C4, C5
		CO 3	C2, C3
		CO4	C2
Total Marks	100%		

REFERENCE BOOKS
1. “Pavement Analysis and Design: Yang H. Huang 2nd edition 2. “Highway Engineering” by – Paul H. Wright (7th Edition) 3. “Transportation Engineering and Transport Planning” by – L.R. Kadiyali 4. “Principles of Pavement design” by – E.J. Yoder 5. “Railway Engineering” by – Rangwala 6. Traffic and Highway Engineering by Garber and Hoel 7. Traffic Engineering by Roger Roess, Elena Prassas, William McSh 8. “Railway Engineering” by – Agarwal (Student Edition) 9. “Highway capacity manual”, transportation research reports, national research council, Washington D.C., 2000. 10. “Introduction to Transportation Engineering”, by - Tom V. Mathew and K V Krishna Rao, NPTEL May 24, 2006 11. Strategic Transport Plan and revised Strategic Transport Plan 12. Geometric Design Standard for Roads and Highways Department Government of Bangladesh

Spring semester L-4, T-I

Sessional (core)

COURSE INFORMATION		
Course Code: Course Title:	CE 452 Highway Materials and Transportation Engineering Design Sessional	Lecture contact hours:3.00 Credit hours:1.50

PRE-REQUISITE
None
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
It is a design course of testing and quality control of highway materials. Bituminous mix design; roadway traffic and capacity analysis. Test of aggregate for abrasion and impact by Los Angles Machine, Determination of Road way capacity and saturation flow at intersection.
OBJECTIVE
• Determine properties of aggregates and bitumen using standard methods • Identify optimum bitumen content by Mix Design • Estimate capacity and saturation flow of a road section
COURSE CONTENT
Testing and quality control of highway materials. Bituminous mix design; roadway traffic and capacity analysis. Test of aggregate for abrasion and impact by Los Angles Machine, Determination of Road way capacity and saturation flow at intersection.

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	Able to **determine** properties of aggregates and bitumen using standard methods.	√											

2	Able to **identify** optimum bitumen content by Mix Design.			√									
3	Able to **determine** properties of aggregates and bitumen using standard methods and road way capacity & traffic saturation flow.				√								

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Able to **determine** properties of aggregates and bitumen using standard methods.	1,	C2	1, 5	-	5	Viva/Quiz/Lab Report
CO2	Able to **identify** optimum bitumen content by Mix Design.	3	C4	1, 5	-	5	Viva/Quiz/Lab Report
CO3	Able to **determine** properties of aggregates and bitumen using standard methods and Road way	4	C4	1, 3, 5	-	5, 6	Viva/Quiz/Lab Report

	capacity & traffic saturation flow.						

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 (2.5 hours/week x 14 weeks)	35
Guided Learning Report Writing (1 hour/week x 14 weeks)	14
Independent Learning Preparation for tests and examination	07
Assessment Quiz Viva	 3 1
Total	60

TEACHING METHODOLOGY

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

TEACHING SCHEDULE

Week	**Topics**	**Assessments**
1	Determination of Aggregate Impact Value Determination of Aggregate Crushing Value	Lab Report/Viva/Quiz
2	Determination of Ten Percent Fines Value Determination of Angularity Number	
3	Determination of Flakiness Index Determination of Elongation Index	
4	Determination of Specific Gravity of Semi-Solid Bituminous Material	Lab Report/Viva/Quiz
5	Determination of Loss on Heating of Oil and Asphaltic Compounds	

6	Determination of Penetration of Bituminous Material Determination of Softening Point of Bituminous Materials	Lab Report/Viva/Quiz
7	Determination of Flash and Fire Points of Bituminous Materials Determination of Ductility of Bituminous Materials	
8	California Bearing Ratio (CBR) Test	
9	California Bearing Ratio (CBR) Test (contd.)	
10	Test of aggregate for abrasion and impact by Los Angles Machine	
11	Marshall Method of Mix Design	
12	Determination of Aggregate Impact Value Determination of Aggregate Crushing Value	Lab Report/Viva/Quiz
13	Determination of Roadway Capacity	
14	Determination of Saturation Flow at Traffic Signals	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Viva	10%	CO1, CO2, CO3	C2, C4
Observation	05%	CO1, CO2, CO3	C2, C4
Report	30%	CO1, CO2, CO3	C2, C4
Presentation	05%	CO3	C4
Quiz	50%	CO1, CO2, CO3	C2, C4
Total Marks	100%	CO1, CO2, CO3	C2, C4

REFERENCE BOOKS

1. Lab Manual based on ASTM, BS standard, STP of RHDMS-2, Asphalt Mix Design Methods, (7th edition) - Asphalt Institute
2. Traffic Engineering and Transportation Planning – Kadiyali
3. Transport Planning and Traffic Engineering - C A O’Flaherty
4. Traffic Engineering Design - Mike Slin
5. Foundation Analysis and Design (5th Ed.) - Joseph E. Bowles.
6. Traffic and Highway Engineering- N. J. Garber and L. A. Hoel, West Publishing Company, MN, 2010

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION			
Course Code: Course Title:	CE 453 Traffic Engineering Design and Management	Lecture contact hours: Credit hours:	2.00 2.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
It is a course depicting traffic flow fundamentals, flow theory, network equilibrium, TIA, traffic control system and design, micro simulation of traffic and ITS, Transportation demand, supply and equilibrium and concepts of traffic managements. After this course students will be able to conduct network analysis using micro simulation software.

OBJECTIVE

- To develop a deep understanding of traffic flow characteristics structural steel
- To gain familiarity with; road traffic assignment, network equilibrium
- Able to demonstrate traffic control devises; Intersection control and design; grade separation and interchanges
- To introduced with advanced concepts of traffic management, management strategies, NMT issues and road safety.

COURSE CONTENT
Analysis of traffic flow characteristics; road traffic assignment, network equilibrium, system optimality; traffic flow theory, shockwaves, deterministic and stochastic queuing analysis; Traffic Impact Assessment (TIA); Introduction to signal optimization tools, traffic control devises; Intersection control and design; grade separation and interchanges; computer application in traffic system analysis; introduction to micro simulation and ITS: Components and Applications; Transportation demand, supply and equilibrium; Advanced concepts of traffic management, management strategies; NMT issues and road safety.

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	Able to **demonstrate** various traffic flow theories.	√											
2	Able to **comprehend** traffic signalling system, demand and micro simulation tools.		√										

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Able to **demonstrate** various traffic flow theories	1	C3	1, 2	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Able to **comprehend** traffic signalling system, demand and micro simulation tools.	2	C4	2	-	4, 5	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 (2 hours/week x 5 weeks)	10
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	35 22
Assessment Continuous Assessment Final examination	2 3
Total	100

TEACHING METHODOLOGY

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

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Analysis of traffic flow characteristics	CT/ Assignment/ Final Exam
	2	Analysis of traffic flow characteristics	
2	4	Network equilibrium	
	5	System optimality	
3	7	Traffic flow theory	
	8	Traffic flow theory	
4	10	Deterministic and stochastic queuing analysis	CT/ Assignment/ Final Exam
	11	Traffic Impact Assessment (TIA)	
5	13	Introduction to signal optimization tools	
	14	Traffic control devises	
6	16	Intersection control and design	Mid Term/ Assignment/ Final Exam
	17	Grade separation	
7	19	Interchanges	
	20	Introduction to micro simulation	
8	22	Components	
	23	Transportation demand	
9	25	Transportation supply	

	26	Demand-supply equilibrium	
10	28	Advanced concepts of traffic management	
	29	Management strategies	
11	31	NMT issues	
	32	Road safety	
12	34	Road traffic assignment	CT/ Assignment/ Final Exam
	35	Shockwaves	
13	37	Introduction to ITS	
	38	Computer application in traffic system analysis	
14	40	ITS Applications;	
	41	Pedestrian Safety	

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%	CO 1	C2
		CO 2	C3
Total Marks	100%		

REFERENCE BOOKS

1. “Highway Engineering” by - Paul H Wright
2. “Traffic Engineering and Transport Planning” by – L.R. Kadiyali
3. “Highways – The Location, Design, Construction” by – Flaherty
4. “Principles of Transportation Engineering “by – Das
5. “Transportation Engineering Handbook” by – Geulias
6. “Traffic and Highway Engineering” by – Garber

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION

Course Code Course Title	: CE 455 : Pavement Management, Drainage and Airport Engineering	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

In this course students will learn to design airfield pavements with software and drainage for highways and airport with appropriate drainage materials. Students will gain knowledge on pavement management system, strengthening and air transportation, aircraft characteristics, configurations, lighting, marking and signage. This will be useful for the students in a later stage of their study, as well as professional life.

OBJECTIVE

- To develop deep understanding on pavement management system (PMS), pavement strengthening, drainage system for highways and airport
- To be acquainted with trends in air transportation, airport configurations and airport planning
- To become skilled at the airfield pavements design using software

COURSE CONTENT

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

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	Ability to **understand** the principles of pavement	√	√										

	management system, strengthening techniques and to **gain** knowledge on air transportation, aircraft characteristics, airport configurations and other important aspects of airport engineering.												
2	Ability to **design** road and airport drainage system with appropriate drainage materials to reduce the water related damage.			√									
3	Ability to **design** airfield pavements using design software.			√		√							

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** the principles of pavement management system, strengthening techniques and to **gain** knowledge on air transportation, aircraft characteristics, airport configurations and	1, 2	C1/C2	1, 2	-	3, 4	Class Test, Mid-term, Pop quiz, Final Exam

	other important aspects of airport engineering.						
CO2	Ability to **design** road and airport drainage system with appropriate drainage materials to reduce the water related damage.	3	C4	1, 2	-	4, 5	Assignment,Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **design** airfield pavements using design software.	3,5	C4	1,5	-	4, 5	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 (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	28 25
Assessment Continuous Assessment Final examination	2 3
Total	95

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE			
Week	**Lecture**	**Topics**	**Assessments**
1	1	Definition of PMS, purposes & activities at different levels of PMS	CT/Assignment/ Final Exam
	2	Pavement condition assessment, determining & prioritizing the needs, life cycle cost analysis	
2	3	Different types of overlay, methods of overlay design	
	4	Reflection cracks and early failure of overlay	
3	5	Importance of highway drainage, surface and sub-surface drainage, typical sketches	CT/Assignment/ Final Exam
	6	Drainage materials: aggregates, criteria for drainage materials	
4	7	Drainage materials: Geotextiles, pipes, and drainage structures	
	8	Introduction: Airports, importance advantages, trends in air transportation	Mid Term/ Final Exam
5	9	Trends in air transportation: global, regional and national aspects (Bangladesh)	
	10	Aircraft Characteristics Related to Airport Design: Dimensional standards, landing gear configuration	
6	11	Aircraft Characteristics Related to Airport Design: Aircraft weight	
	12	Runway: Atmospheric conditions affecting aircraft performance, Basic runway length components	
7	13	Runway: declared distances, runway length calculation	
	14	Types and elements of airport planning studies	
8	15	Airport system plan, airport master plan,	
	16	Airport project plan, airport site selection	
9	17	Geometric design of the airfield: airport Design Standards, airport classifications	
	18	Airport configuration: runway	
10	19	Taxiway, terminal, heliports	

	20	Factors in structural design of flexible and rigid airfield pavements	CT/Assignment/ Final Exam
11	21	Historical development of FAA methods on pavement design	
	22	Introduction with FAARFIELD software	
12	23	Design with FAARFIELD	
	24	Airport lighting, marking and signage: Requirements for visual aids	
13	25	Approach lighting, threshold lighting	
	26	Airport drainage system, ponding and no-ponding condition, typical layout sketches	
14	27	Introduction to airside planning, design and operations software.	
	28	Introduction to airside planning, design and operations software.	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C4
Final Exam	60%	CO 1	C1, C2
		CO 2	C4
		CO 3	C4
Total Marks	100%		

REFERENCE BOOKS

1. Pavement Analysis and Design, Yang H. Huang
2. Planning and Design of Airport, 5th Ed., Horonjeff
3. Airport Engineering Planning, Design and Development of 21st Century Airports, 4th Ed, Norman J. Ashford
4. FAA Advisory Circular 150/5320-6E
5. Transportation Engineering and Transport Planning, L.R. Kadiyali
6. Transportation Planning and Traffic Engineering, O'Flaherty

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 457 : Urban Transportation Planning and Management	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course demonstrates how to conduct an urban transport planning study, develop understanding of urban transport systems. Also enables to develop decision and policy making aids for large-scale, complex transportation systems. Upon completion of this course, students should have basic understanding of about urban transportation planning is, its theoretical backgrounds, applications, details of public transportation system, travel demand forecasting.

OBJECTIVE

- To understand current transportation planning issues, trends, policies and challenges
- To design and execute an urban transportation planning study
- To acquire effective knowledge on travel demand forecasting
- To understand the evaluation of transportation systems
- To learn about the environmental issues and sustainable transport.

COURSE CONTENT

The urban transport problems and trends; road network planning; Sustainable Urban Transportation Index (SUTI);characteristics and operation of different transit and paratransit modes, planning transit network; estimating system costs and benefits, Transit oriented development (TOD); pricing and financing, evaluation, transit users attitude, policies and strategies for transit development in metropolitan cities; freight traffic planning and management; congestion management; safety management; environmental issues and sustainable transport; selected transport 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
1	**Understand** urban transportation issues, trends and challenges.	√											

2	**Comprehend** urban transportation planning skills, especially related to travel demand forecasting		√										
3	**Apply** evaluation techniques to select the most suitable transportation system from different alternatives.			√									

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** urban transportation issues, trends and challenges.	1	C1/C2	1, 2	-	4	CT, Mid and Final exam
CO2	**Comprehend** urban transportation planning skills, especially related to travel demand forecasting	2	C4/C5	3	-	4, 5	CT, Mid and Final Exam
CO3	**Apply** evaluation techniques to select the most suitable transportation system from different alternatives	3	C2/C3	1	-	3, 4	Pop Quiz, CT, Mid- and 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)	28
Guided Learning Tutorial/ Assignments (3 hours/week x 5 weeks)	10
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	24 13
Assessment Continuous Assessment Final examination	 2 3
Total	80

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

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Course Overview, Urban Transportation Planning process	CT/ Assignment/ Final Exam
	2	Urban Transport Problems and Trend	
2	3	Auto Dependency	
	4	Transit Characteristics	
3	5	Transit Characteristics	
	6	Transit User Attitude & STP	
4	7	Urban Transit Challenges	
	8	Congestion	
5	9	Congestion	
	10	Freight and Goods Movement	
6	11	TOD	
	12	TOD	

7	13	Travel demand forecasting	CT / Assignment/ Final Exam
	14	Trip generation	
8	15	Trip generation	Mid Term/ Final Exam
	16	Trip Distribution	
9	17	Trip Distribution	
	18	Mode choice	
10	19	Mode choice	
	20	Trip assignment	
11	21	Trip assignment	
	22	Road master Plan	
12	23	Env issues and sustainable transport	CT/ Assignment/ Final Exam
	24	Env issues and sustainable transport	
13	25	Transit Pricing	
	26	Transport Evaluation	
14	27	Transport Evaluation	
	28	Road Safety	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C1, C2, C3, C4, C5
Final Exam	60%	CO 1	C1, C2
		CO 2	C4, C5
		CO 3	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. “Urban Transportation Planning by M.D. Meyer and E. J. Miller
2. Modelling Transport by Juan de Dios Ortúzar, Luis G. Willumsen
3. Strategic Transport Plan and revised Strategic Transport Plan, Delta Plan, SDG.

4. Banks, James. (2002). Introduction to Transportation Engineering, 2nd Edition, McGraw-Hill Education. ISBN 978 007 1240345.
5. L.R. Kadiyali "Transportation Engineering and Transport Planning".
6. O'Flaherty "Transportation Planning and Traffic Engineering".
7. Mannering, Fred, and Washburn, Scott. (2016). Principles of Highway Engineering and Traffic Analysis, 6th Edition, Wiley. ISBN 978 1 119 299332.
8. Lester A. Hoel , By (author) Nicholas Garber "Traffic and Highway Engineering", SI Edition, English 03 May 2014.
9. T. F. Fwa , " The Handbook of Highway Engineering"
10. AASHTO, "Highway Safety Manual" 2010
11. *In addition, students will be asked to read book sections, journal articles, and web materials

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 459 : Intelligent Transportation System	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course includes components and application of ITS in-traffic management and advanced traveller information system. After this course students are expected to apply ITS in traffic management, toll collection, freight transport and emergency evacuation.

OBJECTIVE

- To develop an understanding of ITS standards and architecture; Environmental aspects of ITS To gain familiarity with limit state design philosophy.
- To demonstrate different aspects, ITS
- To understand different application of ITS

COURSE CONTENT

History of ITS, ITS standards and architecture; Environmental aspects of ITS; Enabling technologies for ITS; Introduction to mobile application for ITS; Introduction to traffic flow modeling and control; Application of ITS for advanced traffic management, advanced traveler information system, public transport, commercial vehicle operation, freeway incident detection and control, electronic toll collection; Connected vehicle technology and applications; ITS benefits, evaluation and costs.; Freight Transport and Logistics; ITS application to Emergency Evacuation of Traffic.

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	Ability to **demonstrate** different aspect ITS.	√											

2	Ability to **understand** different application of ITS.		√										

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **demonstrate** different aspects ITS	1	C3	1, 2	-	4, 5	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **understand** different application of ITS	2	C4	2	-	4, 5	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 (3 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 learning) Preparation for tests and examination	35 22
Assessment Continuous Assessment Final examination	2 3
Total	100

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE			
Week	**Lecture**	**Topics**	**Assessments**
1	1	History of ITS	CT/ Assignment/ Final Exam
	2	ITS standards and architecture	
2	4	Environmental aspects of ITS	
	5	Enabling technologies for ITS	
3	7	Introduction to mobile application for ITS	
	8	Introduction to traffic flow modeling	
4	10	Introduction to traffic control	CT/ Assignment/ Final Exam
	11	Application of ITS for advanced traffic management	
5	13	Advanced traveler information system	
	14	Public transport	
6	16	Commercial vehicle operation	Mid Term/ Assignment/ Final Exam
	17	Freeway incident detection and control	
7	19	Electronic toll collection	
	20	Connected vehicle technology	
8	22	CAV application	
	23	ITS benefits	
9	25	ITS evaluation	
	26	ITS costs	
10	28	ITS application freight transport	
	29	ITS application freight transport	
11	31	ITS application to Emergency Evacuation of Traffic.	
	32	ITS application to Emergency Evacuation of Traffic.	
12	34	ITS application to logistics	CT/ Assignment// Final Exam
	35	ITS application to logistics	
13	37	ITS to TOD	
	38	ITS on traffic signal control	
14	40	ITS application to Bangladesh	
	41	ITS application to Bangladesh	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C3, C4
Final Exam	60%	CO 1	C3
		CO 2	C4
Total Marks	100%		

REFERENCE BOOKS
1. “Principles of Transportation Engineering “by – Das 2. “Transportation Engineering Handbook” by – Geulias 3. “Traffic and Highway Engineering” by – Garber

Fall semester L-4, T-II

Sessional (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 454 : Traffic Studies and Pavement Design Sessional	Lecture contact hours Credit hours	: 3.00 : 1.50

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This course is to develop skills for designing layer thicknesses for highway and airfield pavements, conduct traffic survey and subsequent analysis, design and analysis of road intersection using micro-simulation tools that will be useful in various projects in future.

OBJECTIVE

- To develop skill on how to design layer thicknesses for highways and airfield pavement using both empirical equations/nomographs and Softwares
- To develop the skill to conduct a road condition survey, O-D survey and execute traffic volume and speed studies using field data
- To develop state of the art to analyse traffic and design the road intersection using micro-simulation software, i.e., VISSIM

COURSE CONTENT
Design of flexible and rigid pavement and airfield pavements; Geometric design; road intersection design and interchanges; traffic studies; Computer models and application packages.

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	Ability to **design and analyse** layer thicknesses for highways and airfield pavement using both empirical			√		√							

	nomographs and Software.												
2	Ability to **execute** a road condition & O-D surveys and **conduct** traffic volume & speed studies using field data				√								
3	Ability to **analyse traffic** and **design** the road intersection using micro-simulation software, i.e., VISSIM.			√		√							

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	Ability to **design and analyse** layer thicknesses for highways and airfield pavement using both empirical nomographs and Software.	3, 5	C4, C5	3, 5	-	5,6	Class Assessment/Assignment/Quiz
CO2	Ability to **execute** a road condition & O-D surveys and **conduct** traffic volume & speed studies using field data.	4	C4	1,5	-	4,6	Class Assessment/Assignment/Quiz
CO3	Ability to **analyse traffic** and **design** the road intersection using	4,5	C4, C5	3,4	-	5,6	Class Assessment/Assignment/Quiz

	micro-simulation software, i.e., VISSIM.						

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 (1.5 hours/week x 14 weeks) Class assignment (1 hours/week X14 weeks)	 21 14
Guided Learning Assignment Preparation (1.0 hours/week x 14 weeks)	14
Independent Learning Preparation for tests and examinations	06
Assessment Quiz	05
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	**Topics**	**Assessments**
1	Design of Highway Pavement (Flexible): Design Traffic Calculation, Thicknesses by AASHTO Method 1993	Class Assessment
2	Analysis of Highway Pavement (Flexible): Mechanistic-Empirical method, by Layered elastic system-based software	
3	Highway Pavement Design (Rigid): AASHTO Method	
4	Airport Pvt design (Flexible, Rigid) by CBR based and Westergaard Principle-based	
5	Airport Pvt design (Flexible, Rigid) by CBR based and Westergaard Principle-based	

6	Airport Pvt design (Flexible, Rigid) by FAARFIELD	
7	Mid-term Quiz	Quiz
8	Road condition survey (objects, geometry, elevation, sign, marking, signals)	Class Assessment
9	Traffic volume study and OD survey	
10	Traffic speed survey (SMS, TMS, Spot Speed)	
11	Design of intersection, signal design, lane design, ramp design	
12	Traffic Analysis and design of Intersection with VISSIM	
13	Traffic Analysis and design of Intersection with VISSIM	
14	Final Quiz	Quiz

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Assignment Report & Class Assessment	50%	CO1, CO2, CO3	C3, C4
Quiz	50%	CO 1	C3
		CO 2	C4
		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS

1. The Handbook of Highway Engineering, Edited - T.F. Fwa
2. AASHTO Guide for Design of Pavement Structures 1993
3. Pavement Analysis and Design, Yang H. Huang
4. Road Note 31
5. Pavement Design Guide, RHD
6. Traffic Engineering and Transportation Planning – Kadiyali
7. Transport Planning And TrafficEngineering - C A O’Flaherty
8. Highway Capacity Manual, TRB, USA
9. Geometric Design Standards for RHD
10. Planning and Design of Airport, 5th Ed. – Horonjeff
11. FAA Advisory Circular 150/5320-6E

5.12 Water Resource Engineering

Fall semester L-3, T-II

Theoretical (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 361 : Open Channel Hydraulics	Lecture contact hours Credit hours	: 3.00 : 3.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This course will be helpful for students to learn how to analyze different parameters of the Open channel flow and its classification; velocity and pressure distributions; energy equation, specific energy and transition problems; critical flow and control. In this course, students will also be introduced with the concept of uniform flow, Chezy and Manning equations, estimation of resistance coefficients and computation of uniform flow; momentum equation and specific momentum; hydraulic jump theory and analysis of gradually varied flow; computation of flow profiles; design of channels etc. which will be useful in designing open channel i.e. drainage channels or irrigation canals etc.

OBJECTIVE

- To learn the energy and momentum theories for flow through open channels.
- To understand the Manning's and Chezy's equation in designing open channels.
- To estimate energy dissipation due to hydraulic jumps in open flows.
- To design different type of channels and compute numerically the flow profiles.

COURSE CONTENT
Open channel flow and its classification; velocity and pressure distributions; energy equation, specific energy and transition problems; critical flow and control; 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

COURSE OUTCOMESAND SKILL MAPPING

No.	COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

1	**Devise** the energy and momentum theories for flow through open channels	√											
2	**Apply** the Manning's and Chezy's equation in measurement of channel parameters		√										
3	**Estimate** energy dissipation due to hydraulic jumps in open flows		√										
4	**Design** different type of channels and **compute** numerically the flow profiles			√									

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom' s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Devise** the energy and momentum theories for flow through open channels	1	C2	1	-	1, 2	Pop Quiz, Final Exam
CO2	**Apply** the Manning's and Chezy's equation in measurement of channel parameters	2	C3	3	-	2,3	Mid-Term, Final Exam
CO3	**Estimate** energy dissipation due to hydraulic jumps in open flows	2	C3	3	-	2,3	Mid-Term, Final Exam
CO4	**Design** different type of channels and **compute** numerically the flow profiles	3	C3	1	-	4	Class Test, Final Exam

WP= Washington Accord Complex Problem/ CP= Complex Problem; 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, Tutorial and Problem Based Learning

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Basic concepts of Open Channel Flow	CT/ Assignment/ Final Exam
	2	Characteristics of open channel flow	
	3	Effect of gravity and viscosity on flow	
2	4	Velocity and pressure distribution	
	5	Correction factors for velocity and momentum	
	6	Continuity and Energy equation	
3	7	Concept of Specific energy, specific energy curve	
	8	Transition problem	
	9	Concept of Critical flow	
4	10	Theories related to critical flow	CT/ Assignment/ Final Exam
	11	Computation of critical depths: analytical method	
	12	Computation of critical depths: trial and error method	
5	13	Concept of uniform flow	
	14	Uniform flow formulas	

	15	Chezy's and Manning's equation	
6	16	Resistance coefficients	Mid Term/ Assignment/ Final Exam
	17	Computation of normal depth	
	18	Uniform flow for complex channels	
7	19	Hydraulic exponent for uniform flow computation	
	20	Computation of normal and critical slopes	
	21	Channel sections with composite roughness	
8	22	Compound Cross-sections	
	23	Principles of flow measurement and devices	
	24	Gradually Varied Flow (GVF): definition	
9	25	Dynamic equations of GVF, channel slopes	
	26	Flow profiles on Mild and Steep slopes	
	27	Flow profiles on Critical, Horizontal and Adverse slopes	
10	28	Draw simple profiles	
	29	Practice complex profiles	
	30	Calculation of critical and uniform depths	
11	31	Calculation of simple flow profiles	
	32	Description of Direct Step method	
	33	Numerical computation of flow profiles using direct step method	
12	34	Hydraulic Jump: definition, practical use, types etc	CT/ Assignment/ Final Exam
	35	Hydraulic Jump: derivation of different theories	
	36	Hydraulic Jump: computation of jumps and losses of energies	
13	37	Design of Channels: basics, definition, design of simple channels	
	38	Design of best hydraulic sections	
	39	Design of erodible channels (theory)	
14	40	Design examples of erodible channels	
	41	Design of Alluvial channels: theory	
	42	Design examples of Alluvial channels	

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C3
Final Exam	60%	CO 2, CO 3, CO 4	C3, C3, C3
Total Marks	100%		

REFERENCE BOOKS

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

Spring Semester L-4, T-I

Theoretical (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 463 : Hydrology and Irrigation Engineering	Lecture contact hours Credit hours	: 4.00 : 4.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This course will be helpful for students to learn about Hydrologic cycle; Weather and hydrology; Precipitation, evapo-transpiration; Infiltration; Stream flow; Application of telemetry and remote sensing in hydrologic data acquisition; Rainfall-runoff relations; Hydrographs, unit hydrographs; Hydrologic routing; Statistical methods in hydrology etc. In this course, students will also be introduced with the concept of Plant-soil-water relationship; Consumptive use and estimation of irrigation water requirements; Design of irrigation canal system; Methods of irrigation; quality of irrigation water; problems of irrigated land etc. which will be useful in handling various projects in their professional life.			
OBJECTIVE			
• To learn basic concepts of hydrology, various process, measurement and estimation of hydrological components: precipitation, evaporation, stream flow etc, • To understand rainfall-runoff relationship, hydrographs and apply various statistical methods for hydrological analysis, • To understand the basic requirements of irrigation and various irrigation techniques, crop water requirements etc, • To design different irrigation canals required for a project with other hydraulic structures			
COURSE CONTENT			
Hydrologic cycle; Weather and hydrology; Precipitation, evaporation and transpiration; Infiltration; Stream flow; Application of telemetry and remote sensing in hydrologic data acquisition; Rainfall-runoff relations; Hydrographs, unit hydrographs; Hydrologic routing; Statistical methods in hydrology; Plant-soil-water relationship; Consumptive use and estimation of irrigation water requirements; Design of irrigation canal system; Methods of irrigation; quality of irrigation water; problems of irrigated land.			
COURSE OUTCOMESAND SKILL MAPPING			

No.		PROGRAMME OUTCOMES (POs)

	COURSE OUTCOMES (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	**Describe** the basic concepts of hydrology, various process, measurement and estimation of hydrological components: precipitation, evaporation, stream flow etc.	√											
2	**Develop** rainfall-runoff relationship, hydrographs and apply various statistical methods for hydrological analysis.		√										
3	**Understand** the basic requirements of irrigation and various irrigation techniques, crop water requirements etc.	√											
4	**Design** different irrigation canals required for a project with other hydraulic structures.			√									

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP (WP)	CA (EA)	KP (WK)	Assessment Methods
CO1	**Describe** the basic concepts of hydrology, various process, measurement and estimation of hydrological components: precipitation,	1	C2	1	-	1	Pop Quiz, Final Exam

	evaporation, stream flow etc.						
CO2	**Develop** rainfall-runoff relationship, hydrographs and apply various statistical methods for hydrological analysis.	2	C4	3	-	2,3	Mid-Term, Final Exam
CO3	**Understand** the basic requirements of irrigation and various irrigation techniques, crop water requirements etc.	1	C2	1	-	1,4	Mid-Term, Final Exam
CO4	**Design** different irrigation canals required for a project with other hydraulic structures.	3	C3	1	-	4	Class Test, Final Exam

WP= Washington Accord Complex Problem/ CP= Complex Problem; 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)	56
Guided Learning Tutorial/ Assignments (3 hours/week x 5 weeks)	14
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	48 36
Assessment Continuous Assessment Final examination	3 3
Total	160

TEACHING METHODOLOGY

Lecture and Tutorial, Problem Based Learning (PBL)

TEACHING SCHEDULE		
Week	**Topics**	**Assessments**
1	Introduction: Hydrological Cycle, Catchment Area Introduction: Water Budget Equation, Residence Time Weather System: Temperature and Pressure variation in the atmosphere; Weather parameter estimation	CT/ Assignment/ Final Exam
2	Weather System: Precipitable water in the air column Precipitation: Formation of precipitation, Forms of precipitation Precipitation: Measurement of precipitation, Computation of average rainfall, Analysis of Rainfall Data	
3	Precipitation: Analysis of Rainfall Data; Presentation of Rainfall Data Evaporation: Evaporation process, Estimation of evaporation Evaporation: Transpiration and Evapo-transpiration, Estimation of Potential Evapo-transpiration	
4	Runoff: Components of runoff; Stream characteristics; Yield of a river, Rainfall & Runoff correlation Runoff: Flow-Duration curve; Drought: Occurrence, Classification and Management Stream Flow Measurement: Stream; Stream Flow and its measurement; Stage of a river and its measurement; Measurement of Discharge by Area-Velocity method	CT/ Assignment/ Final Exam
5	Stream Flow Measurement: Shifting and Permanent Control; Stage (G)-Discharge (Q) Relationship; Extrapolation of rating curve Infiltration: Infiltration and Infiltration Capacity, Horton's equation for Infiltration Capacity Infiltration: Horton's equation for Infiltration Capacity, Infiltration Index	
6	Infiltration: Infiltration Index Flood: Flood and Peak Flood, Estimating magnitude of peak flood: Rational Method Flood: Flood frequency analysis for estimating peak flood	Mid Term/ Assignment/ Final Exam
7	Flood: Risk and safety factor Hydrograph: Storm Hydrograph and its component; Factors affecting flood/storm hydrograph Hydrograph: Base flow separation technique for measuring Direct Runoff Hydrograph (DRH)	

8	Irrigation: definition, importance, advantages and ill-effects Methods of irrigation: surface method Methods of irrigation: furrow, sprinkler and drip method	
9	Development of an irrigation project Sources and Quality of irrigation water Quality related problems	
10	Effective rainfall and irrigation efficiencies Estimation of crop water requirement Irrigation scheduling	
11	Delta and duty Calculation of available water and scheduling Soil-water relationship	
12	Measurement techniques of soil moisture Systems of irrigation canals Components of an irrigation canal	CT/ Assignment/ Final Exam
13	Physical and economic justification of canals Design parameters of irrigation canals Design of lined and unlined canals	
14	Design of alluvial canals Diversion head works Diversion head works	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C3, C4
Final Exam	60%	CO 2	C4
		CO 3	C2
		CO 4	C3
Total Marks	100%		

REFERENCE BOOKS

1. Irrigation Engineering and Hydraulic Structures by Garg
2. Irrigation Principles and Practices byVaughn, E. Hansen, Orson W. Israelsen

3. Introductory Irrigation Engineering by B.C. Punmia
4. Irrigation Engineering byS.Leliavsky
5. Engineering Hydrology by Subramanya

Fall Semester L-3, T-II

Sessional (Core)

COURSE INFORMATION			
Course Code Course Title	: CE 362 : Open Channel Hydraulics Sessional	Lecture contact hours Credit hours	: 3.00 : 1.50

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
It is a sessional course where students can have a hand on experiment about the state of flow; flow over a broad crested weir; flow through a venturi flume; flow through a Parshall flume; flow beneath a sluice gate; study on hydraulic jump; specific energy and specific force curves; discharge and mean velocity of an open channel; change in water surface due to raised channel bottom etc. which will be useful in understanding behavior of flow through open channels.

OBJECTIVE
• To learn the state of flow while passing through open channels with velocity and discharge variation, • To devise the flow profiles and losses of energy when open channel flows passing through different hydraulic structures i.e., weir, sluice gate etc, • To apply the theories of energy and forces on open channel flows, • To learn basics about numerical modelling of 1D and 2D flows through open channels.

COURSE CONTENT
Broad-crested weir; sluice gate; venturi flume; Parshall flume; cutthroat flume; hydraulic jump; velocity distribution profile; Manning's roughness coefficient; specific force and specific energy; Hydraulic Modelling: basic principles of modelling 1D and 2D river flow, build a model and interpret results of a river flow model.

COURSE OUTCOMESAND SKILL MAPPING

No.	COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	**Understand** the state of flow while passing through open channels with velocity and discharge variation.	√											

2	**Devise** the flow profiles and losses of energy when open channel flows passing through different hydraulic structures i.e. weir, sluice gate etc.		√										
3	**Apply** the theories of energy and force on open channel flows.		√										
4	**Understand** the basics about numerical modelling of 1D and 2D flows through open channels.					√							

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP (WP)	CA (EA)	KP (WK)	Assessment Methods
CO1	**Understand** the state of flow while passing through open channels with velocity and discharge variation.	1	C2	-	1	5	Lab Report + Quiz+ Viva
CO2	**Devise** the flow profiles and losses of energy when open channel flows passing through different hydraulic structures i.e., weir, sluice gate etc.	2	C3	-	1	3, 6	Lab Report + Quiz + Viva
CO3	**Apply** the theories of energy and force on open channel flows.	2	C3		3	3	Lab Report + Quiz + Viva

CO4	**Understand** the basics about numerical modelling of 1D and 2D flows through open channels.	5	C2	-	1	5	Class Work

WP= Washington Accord Complex Problem/ CP= Complex Problem; 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 10 weeks)	30
Guided Learning Report Writing (1 hour/week x 9 weeks)	01
Independent Learning Individual learning	10 08
Assessment Quiz +Viva	2
Total	60

TEACHING METHODOLOGY

Lecture and Experiments, Software applications

TEACHING SCHEDULE

Week	**Topics**	**Assessments**
1	Introduction	Lab Manual, Lecture notes, Reference texts etc.
2	Determination of State of Flow and Critical Depth in Open Channel	
3	Flow over Broad Crested Weir	
4	Flow through a Venturi Flume	
5	Flow through a Parshall Flume	
6	Flow beneath a Sluice Gate	
7	Mid Quiz	
8	Study on Hydraulic Jump	

9	Development and Generalized Specific Energy and Specific Force Curves	
10	Determination Discharge and Mean Velocity of an Open Channel	
11	Determination of Change in Water Level due to Raised Channel Bottom	
12	Development of 1D and 2D River flow model	
13	Development of 1D and 2D River flow model	
14	Final Quiz + Viva	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Conduct Lab Test & Lab Report)	40%	CO1, CO2, CO3	C2, C3
Quiz & Viva	60%	CO 1, CO 2, CO 3	C2, C3, C3
Total Marks	100%		

REFERENCE BOOKS

1. Open Channel Hydraulics Sessional Lab Manual
2. Open Channel Flow by V.T. Chow

Fall Semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 465 : Groundwater Engineering	Lecture contact hours Credit hours	: 2.00 : 2.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
In this course students will beable 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 managementwhich will enhance their skills in proper using of groundwater as drinking or irrigation purposes.			
OBJECTIVE			
• To understand the basics of ground water, their physical properties and principles of groundwater movement, • To understand and apply knowledge regarding groundwater resource evaluation, contaminant transport; recharge of groundwater; saline water intrusion in aquifers; groundwater management etc.			
COURSE CONTENT			
Groundwater in hydrologic cycle and its occurrence; physical properties and principles of groundwater movement; groundwater and well hydraulics; groundwater resource evaluation; ground water levels and environmental influences; water mining and land subsidence; groundwater pollution and contaminant transport; recharge of groundwater; saline water intrusion in aquifers; groundwater management.			

COURSE OUTCOMESAND 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; physical properties and principles of groundwater movement; well hydraulics	√	√										

2	**Apply** knowledge regarding groundwater resource evaluation, 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; physical properties and principles of groundwater movement; well hydraulics	1, 2	C2	1	-	5	CT/ Assignment/ Final Exam
CO2	**Apply** knowledge regarding groundwater resource evaluation, contaminant transport; recharge of groundwater; saline water intrusion in aquifers; groundwater management	2, 3	C3	1	-	3, 5	Mid Term/ Assignment/ Final Exam

WP= Washington Accord Complex Problem/ CP= Complex Problem; 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	22

Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	15
Assessment Continuous Assessment Final examination	 2 3
Total	80

TEACHING METHODOLOGY

Lecture and Tutorials, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Topics	Assessments
1	Introduction to Groundwater Engineering	CT/ Assignment/ Final Exam
	Groundwater in hydrologic cycle and its occurrence	
2	Groundwater in hydrologic cycle and its occurrence	
	Physical properties of groundwater movement	
3	Physical properties of groundwater movement	
	Principles of groundwater movement	
4	Principles of groundwater movement	
	Principles of groundwater movement	
5	Groundwater and well hydraulics	
	Groundwater and well hydraulics	
6	Groundwater and well hydraulics	Mid Term/ Assignment/ Final Exam
	Groundwater resource evaluation	
7	Groundwater resource evaluation	
	Groundwater level sand environmental influences	
8	Groundwater level sand environmental influences	
	Groundwater level sand environmental influences	
9	Water mining and land subsidence	
	Water mining and land subsidence	
10	Groundwater pollution and contaminant transport	

	Groundwater pollution and contaminant transport	
11	Groundwater pollution and contaminant transport	
	Recharge of groundwater	
12	Recharge of groundwater	CT/ Assignment/ Final Exam
	Saline water intrusion in aquifers	
13	Saline water intrusion in aquifers	
	Groundwater management	
14	Groundwater management	
	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

Fall Semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 467 : Flood Mitigation and Management	Lecture contact hours Credit hours	: 2.00 : 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 Flood and its causes; management of flood water, structural and non-structural measures to mitigate flood damage. The course will be very helpful in their professional life as Bangladesh is facing flooding problem every year.			
OBJECTIVE			
• To understand the basics of flood and its causes; structural and non-structural methods of flood management • To understand the economic aspects of flood management including flood risk and vulnerability analysis, direct and indirect losses of flood, flood damage assessment etc			
COURSE CONTENT			
Flood and its causes; methods of flood management: structural and non-structural measures such as reservoirs, levees and flood walls, channel improvement, interior drainage, flood ways, land management, flood proofing, flood zoning, flood hazard mapping, flood forecasting and warning. Economic aspects of flood management: flood risk and vulnerability analysis, direct and indirect losses of flood, flood damage assessment, flood damage in urban and rural areas.			

COURSE OUTCOMESAND 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 flood and its causes; structural and non-structural methods of flood management	√											

2	**Apply** the economic aspects of flood management including flood risk and vulnerability analysis, direct and indirect losses of flood, flood damage assessment, flood damage in urban and rural areas.		√										

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 flood and its causes; structural and non-structural methods of flood management.	1	C2	1	-	5	CT/ Assignment/ Final Exam
CO2	**Apply** the economic aspects of flood management including flood risk and vulnerability analysis, direct and indirect losses of flood, flood damage assessment, flood damage in urban and rural areas.	2	C3	1	-	3, 5	Mid Term/ Assignment/ Final Exam

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

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, Tutorials

TEACHING SCHEDULE

Weeks	Topics	Assessments
1	Introduction to Flood Mitigation and Management	CT/ Assignment
	Types of flood and its causes	
2	Types of flood and its causes	
	Structural methods of flood management: reservoirs	
3	Structural methods of flood management: levees	
	Structural methods of flood management: embankment	
4	Structural methods of flood management: flood walls	
	Structural methods of flood management: flood bypass	
5	Non-Structural methods of flood management: land management	
	Non-Structural methods of flood management: flood proofing	
6	Non-Structural methods of flood management: flood zoning	Mid Term/ Assignment
	Non-Structural methods of flood management: flood hazard mapping	
7	Non-Structural methods of flood management: flood forecasting	
	Non-Structural methods of flood management: early warning system	
8	Functions and ecology of river-floodplain system	
	Functions and ecology of river-floodplain system	

9	Functions and ecology of river-floodplain system	
	Flood risk and vulnerability analysis	
10	Flood risk and vulnerability analysis	
	Flood risk and vulnerability analysis	
11	Flood forecasting	
	Economic aspects of flood management: direct losses of flood	
12	Economic aspects of flood management: indirect losses of flood	CT/ Assignment
	Flood damage assessment	
13	Flood damage assessment	
	Flood damage in urban and rural area	
14	Flood damage in urban and rural area	
	Review Class	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Assignments/CT/Mid Term)	40%	CO1, CO2	C2, C3
Final Exam	60%	CO1	C2
		CO2	C3
Total Marks	100%	CO1, CO2	C2, C3

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 469 : River Engineering	Lecture contact hours Credit hours	: 2.00 : 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 river engineering and the morphological processes related to river. After this course they will become skilled at the design and construction of different types of small structures such as groyne, guide bund etc which will enhance their skills of designing hydraulic structures in professional life.			
OBJECTIVE			
• To gain knowledge on the basics of river engineering, morphology, scouring and the aggradation-degradation processes. • To gain the basic knowledge on river training work and be able to design different types of structures such as groyne, guide bund etc.			
COURSE CONTENT			
Introduction to River Engineering; Rivers and their behaviour; River channel pattern and fluvial process; River Morphology; River Training and Bank protection; Aggradation and Degradation; Local Scour; Navigation and Dredging; Introduction to flood and its control.			

COURSE OUTCOMESAND 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 river engineering, morphology, scouring and the aggradation-degradation process.	√											

2	**Apply** the understanding of basic knowledge on river training work and **design** of river training works.		√	√									

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 river engineering, morphology, scouring and the aggradation-degradation process.	1	C2	1	-	5	CT/ Assignment/ Final Exam
CO2	**Apply** the understanding of basic knowledge on river training work and **design** of river training works.	2, 3	C3	1	-	3, 5	Mid Term/ Assignment/ Final Exam

WP= Washington Accord Complex Problem/ CP= Complex Problem; 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, Problem Based Learning

TEACHING SCHEDULE			
Week	**Lecture**	**Topics**	**Assessments**
1	1	Introduction to River Engineering	CT/ Assignment/ Final Exam
	2	Classification of rivers, Basic river parameters, Meandering processes and its parameters, Development of Oxbow lake	
2	3	Basic river channel pattern, Agents and processes that shape the earth surface River system and parts of a river system Stream patterns on landform	
	4	Introduction to river morphology Fluvial processes Impact of fluvial processes on landscape Some basic stream pattern	
3	5	Classification of erosion, Valley and interfluve, The shaping and reshaping of valleys and interfluves	
	6	Introduction to floodplain, Stream rejuvenation, Formation of landforms	
4	7	Introduction to River training works, Objective of river training works	
	8	Classification of different river training works Brief on the types of river training works	
5	9	Groyne, Guide bank, Levees, Embankment Typical layout of river training works Classification of guide bund Design considerations of a guide bund	
	10	Typical design of a guide bund.	
6	11	Groyne, Objectives of groyne, Types of groyne Suitability of groyne and its applicability in the river training work Description of different types of groyne	Mid Term/ Assignment/ Final Exam
	12	Introduction to levees or marginal bund Design consideration of levees Causes of failure of a levee	
7	13	Advantages and disadvantages of river training by embankment	

		Suitability of different hydraulic structure in Bangladesh	
	14	Different types of bank protection work Purpose of bank protection	
8	15	Applicability of Sheet pile, Riprap, Gabions and Falling Apron	
	16	Introduction to navigation and dredging Various requirements of a navigable waterway Brief on various measures on achieving navigability Description of open channel method	
9	17	Importance of contraction works in the river training works Lock and Dam arrangement in a river Different types of dam, barrages and weirs	
	18	Introduction to different temporary river improvement technique Details of bandaling system and its feasibility Surface panel system and its applicability	
10	19	Dredging and its classification Different types of dredgers used to achieve navigability Brief on bucket dredger, cutter dredger, dustpan dredger and hopper dredger.	
	20	Aggradation and degradation process in a river, Lanes balance analogy	
11	21	Effects of aggradation and degradation in a river bed and banks	
	22	Effects of aggradation and degradation in a river bed and banks Measures to prevent the degradation process in a river. Occurrence of aggradation in a channel.	
12	23	Scouring and its classification. Differences between general scour, constriction scour and local scour, Clear water scour and live bed scour, Local scour and its types, Possible cases of local scour and local scour around a bridge pier	CT/ Assignment/ Final Exam
	24	Flow pattern around a cylindrical pier Formation of horseshoe vortex and cast-off vortices Scouring process around an abutment. Scouring due to the presence of hydraulic structure Some problems related to local scouring	
13	25	Sediment transport in a river channel	

		A complete river system Types of sediment transport	
	26	Description of sediment load Sediment characteristics Brief on different sediment transport model	
14	27	Flood and its control River training to control flood River training to guide flow	
	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. River Engineering- K D Gupta
2. Fluvial Processes in River-Howard H Chang
3. River Mechanics- Pierre r Julian

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION

Course Code	: CE 471	Lecture contact hours	: 2.00
Course Title	: Hydraulic Structures	Credit hours	: 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

In this course students can learn about basic principles and analysis of both static and dynamic water loads, failure characteristics and operation of hydraulics structures. After this course they will be able to perform design calculations of different hydraulic structures which will enhance their skills of designing hydraulic structures in professional life.

OBJECTIVE

- Integrate the hydraulics and water resources background in water structures design applications
- Develop understanding of the basic principles and concepts of analysis and design of hydraulic structures
- Undertake basic design calculations of different hydraulic structures

COURSE CONTENT

Hydraulic structures – characteristics and types: Diversion head works; Principles of design hydraulic structures; Design of dams, barrages, weirs, spillways, energy dissipators; Cross drainage works, Reservoir, Navigation Lock.

COURSE OUTCOMESAND SKILL MAPPING

No.	COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	**Understand** the basic principles and analysis of both static and dynamic water loads, failure characteristics and operation of hydraulics structures.	√											

2	**Apply** understanding of the basic principles and concepts of analysis and design of hydraulic structures			√									

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** the basic principles and analysis of both static and dynamic water loads, failure characteristics and operation of hydraulics structures.	1	C2	1	-	5	CT/ Assignment/ Final Exam
CO2	**Apply** understanding of the basic principles and concepts of analysis and design of hydraulic structures.	3	C3	1	-	3, 5	Mid Term/ Assignment/ Final Exam

WP= Washington Accord Complex Problem/ CP= Complex Problem; 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 Tutorials, Design Projects, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Fundamentals of hydraulic structures	CT/ Assignment/ Final Exam
	2	Different types of Hydraulic Structures	
2	3	Failure of foundation, Seepage theory	
	4	Bligh’s and Lane’s Creep theory	
3	5	Khosla’s theory	
	6	Examples based on Khosla’s theory	
4	7	Weir: definition, types, design parameters	
	8	Design of a vertical drop weir	
5	9	Design details of weir foundation	
	10	Barrage: details design parameters	
6	11	Design of a modern barrage	Mid Term/ Assignment/ Final Exam
	12	Dam: classification, components, construction of dams	
7	13	Gravity dam, arch dam, buttress dam and embankment dam	
	14	Safety of a dam and rehabilitation	
8	15	Design of a Gravity Dam: Stability check	
	16	Design of a Gravity Dam: detail design	
9	17	Spillway: necessity, location and discharge capacity of spillways	
	18	Spillway: types, components, spillway gates	
10	19	Design of Ogee Spillway	
	20	River Training Works	
11	21	Guide Bank	
	22	Detail design of a guide bank	

12	23	Groynes, Cut-offs, Launching apron	CT/ Assignment/ Final Exam
	24	Cross drainage works	
13	25	Design of a cross drainage works	
	26	Reservoir: characteristics, capacity, sedimentation	
14	27	Energy dissipator, design of stilling basin	
	28	Review	

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. Irrigation Engineering and Hydraulic Structures by S K Garg
2. Irrigation and Water Power Engineering by Punmia
3. Hydraulics of Spillways and Energy Dissipators by Khatsuria
4. Irrigation and Water Resources Engineering by Asawa

Fall semester L-4, T-II

Theoretical (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 473 : Coastal Engineering	Lecture contact hours Credit hours	: 2.00 : 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 coast and coastal features; deltas and estuaries; tide; wave; storm surge; tsunami; port, dock and harbour; wave forces on coastal structures; coastal sedimentation processes. After this course they will become skilled at the design and construction of different types of shore protection works which will enhance their skills of designing coastal structures in professional life.			
OBJECTIVE			
• To understand characteristics of tides, theory behind tidal analysis and prediction, tidal flow measurement, • To understand and apply the principles of coastal processes, sediment transport, deltas and delta management plan, estuary and estuarine control, • To be skilled at fundamental concepts in designing shore protection works.			
COURSE CONTENT			
Coast and coastal features; deltas and estuaries; tide; wave; storm surge; tsunami; port, dock and harbour; wave forces on coastal structures; coastal sedimentation processes; shore protection works; design of shore protection structure.			

COURSE OUTCOMESAND 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 coastal processes ie waves, tides, sediment transport and able to calculate forces on coastal structures.	√											

2	**Apply** the understanding of basic knowledge to design shore protection work.			√									

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 coastal processes ie waves, tides, sediment transport and able to calculate forces on coastal structures.	1	C2	1	-	3	CT/ Assignment/ Final Exam
CO2	**Apply** the understanding of basic knowledge to design shore protection work.	3	C3	3	-	3, 5	Mid Term/ Assignment/ Final Exam
WP= Washington Accord Complex Problem/ CP= Complex Problem; 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, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Introduction to Coastal Engineering	CT/ Assignment/ Final Exam
	2	Tides and coastal processes: Terms and Definitions, Characteristics of tides, Tide chart	
2	3	Theory behind tidal analysis and prediction, Methods of tidal analysis and prediction	
	4	Harmonic analysis of water level and current data	
3	5	Definition of wave parameters, waves and its characteristics	
	6	Linear wave theory: wave celerity, length, and period, the sinusoidal wave profile	
4	7	Sediment transport	
	8	Sediment transport	
5	9	Deltas, deltaic coasts, delta morphologies	
	10	Storm surge, wind stress	
6	11	Tsunami: physical characteristics of tsunami, causes of tsunami	Mid Term/ Assignment/ Final Exam
	12	Tsunami: mitigation of risks and hazards, prediction and early warnings	
7	13	Hydrodynamics and Sediment Dynamics of Tidal Inlets	
	14	Coastal-Offshore Ecosystem	
8	15	Estuarine Sediment Dynamics	
	16	Estuarine Cohesive Sediment Dynamics	
9	17	Offshore and Coastal Modelling	
	18	Harbour layout: Types, port terms, site selection, features	
10	19	Harbour planning and Layout	
	20	Types and function of coastal structures	
11	21	Design of shore protection works	
	22	Design of shore protection works	

12	23	Functional design of coastal structures	CT/ Assignment/ Final Exam
	24	Design of coastal revetments	
13	25	Design of coastal sea walls	
	26	Design of coastal sea bulkheads	
14	27	Environmental impacts of coastal structures	
	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. 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

Fall semester L-4, T-II

Sessional (Elective)

COURSE INFORMATION			
Course Code Course Title	: CE 472 : Hydraulic Structure Design Sessional	Lecture contact hours Credit hours	: 3.00 : 1.50
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
It is a design sessional course where students can know about design requirements as well as detail design (hydrologic, hydraulic, structural and foundation design) of a hydraulic structure which will be useful in their professional life.			
OBJECTIVE			
• To gain knowledge on the basics of hydrologic, hydraulic and structural design requirements and techniques. • To become skilled at the design and construction of different hydraulic structures.			
COURSE CONTENT			
Introduction to hydraulic structure design and design requirements, basic techniques of hydrologic design, detail hydraulic design of a small hydraulic structure (regulator) and design of the structural elements of a regulator and stability analysis.			

COURSE OUTCOMESAND SKILL MAPPING

No.	COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	**Understand** the basic requirements of hydrologic, hydraulic and structural design of a hydraulic structure.	√											

2	**Design** in details and **draw** cross-sections of different elements of a hydraulic structure.			√									

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP (WP)	CA (EA)	KP(WK)	Assessment Methods
CO1	**Understand** the basic requirements of hydrologic, hydraulic and structural design of a hydraulic structure.	1	C2	1	-	5	Lab Report + Quiz+ Viva
CO2	**Design** in details and **draw** cross-sections of different elements of a hydraulic structure.	3	C3	1, 7	-	3, 5	Lab Report + Quiz + Viva
WP= Washington Accord Complex Problem/ CP= Complex Problem; 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 10 weeks)	30
Guided Learning Report Writing (1 hour/week x 9 weeks)	01
Independent Learning Individual learning	10 08
Assessment Quiz +Group Presentation	2
Total	60

TEACHING METHODOLOGY

Lecture and Discussion, Design Calculation, Drawing

TEACHING SCHEDULE

Week	Topics	Assessments
1	Introduction to hydraulic structure design and design requirements	Lab Manual, Lecture notes, Reference texts etc.
2	Development of 6-h Unit Hydrograph Computation of Runoff Hydrograph	
3	Development of stage-discharge curve Discharge (D) vs ($\frac{2S}{t} + D$) curve generation	
4	Flood Routing by Goodrich Method Determination of Glacis Height	
5	Design of stilling basin Computation of Cut-off Depth Determination of Floor Length and Stilling Basin Parameters	
6	Flow beneath a Sluice Gate	
7	Mid Quiz	
8	Determination of Floor Thickness & Exit Gradient Design of Launching Apron	
9	Total Load Calculation Determination of Factor of Safety	
10	Reinforcement Detailing of Top and Bottom Slab	
11	Design of Abutment and Pier	
12	Design of Retaining Wall	
13	Final Quiz + Group Presentation	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Continuous Assessment (Design Calculations)	40%	CO1, CO2	C2, C3
Quiz and presentation	60%	CO 1	C2
		CO 2	C3
Total Marks	100%		

REFERENCE BOOKS

1. Irrigation Engineering & Hydraulic Structures - Santosh Kumar Garg
2. Design of small-scale water control structures

5.13 Final Year Research Project

Level-4 Term- I & II

Spring and Fall Semester

COURSE INFORMATION			
Course Code Course Title	: CE 400 : Final Year Research Project (FYP)	Lecture contact hours Credit hours	: 4 hrs/week in 4/1 and 8hrs/week in 4/2 : 6.00 credit

PRE-REQUISITE
None
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
The course will help students to understand the research process with the help of relevant literature review, experimentation, and in-depth investigation in structural engineering, environmental engineering, transportation engineering, geotechnical engineering and water resource engineering. Students will develop critical thinking capacity, improve communication and analytical skills. Students will be able to create a proper engineering project work as per engineering dissertation/ thesis format.
OBJECTIVE
1. To gain knowledge about the research process with the help of relevant literature review. 2. To solve a problem individually or as a team with a guidance from the supervisor(s).
COURSE CONTENT
Experimental and theoretical investigation of various topics in structural engineering, environmental engineering, transportation engineering, geotechnical engineering and water resource 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 report at the end of the work and present his/her work in front of a board consists of faculty member(s).

COURSE OUTCOMESAND SKILL MAPPING

No.	COURSE OUTCOMES (COs)	PROGRAMME OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Able to **acquire** academic knowledge through independent studies of relevant literature to												√

	cultivate the problem statements and objectives of the research work.												
2	Able to **formulate** research methodology incorporating clear fundamentals, theories and benchmarked against standard practices governing the research work.				√								
3	Able to **conduct** research experiments, **analyze** and **interpret** data and deduce logical conclusions based on knowledge in the broadest context.				√								
4	Able to **communicate** through clear research writing conform to standard thesis format and performs verbal presentation.										√		
5	Able to **acknowledge** the concept and idea of existing research through proper citation.								√				

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP (WP)	CA (EA)	KP (WK)	Assessment Methods
CO1	Able to **acquire** academic knowledge through independent studies of relevant literature to cultivate the problem statements and objectives of the research work.	12	C3	-	-	3	Viva/ Presentation

CO2	Able to **formulate** research methodology incorporating clear fundamentals, theories and benchmarked against standard practices governing the research work.	4	C6	-	3	3	
CO3	Able to **conduct** research experiments, **analyze** and **interpret** data and deduce logical conclusions based on knowledge in the broadest context.	4	C3, C4	-	3	2, 6	Viva/ Presentation
CO4	Able to **communicate** through clear research writing conform to standard thesis format and performs verbal presentation.	10	-	-	-	-	
CO5	Able to **acknowledge** the concept and idea of existing research through proper citation.	8	-	-	-	8	

WP= Washington Accord Complex Problem/ CP= Complex Problem; 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 hrs/week in 4/1 and 8hrs/week in 4/2)	168
Guided Learning Tutorial/ Experimentation/Modeling	32
Independent Learning Individual learning Preparation for Viva and presentation	 30 30
Assessment Viva Presentation	 1 1
Total	322

TEACHING METHODOLOGY			
Lecture and Discussion, Problem Based Learning (PBL)			
ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment Viva Presentation	100%	CO1, CO2, CO3, CO4, CO5	C3, C4, C6
Total Marks	100%		

CHAPTER 6

6.1 Interdisciplinary Courses (EWCE, PME, CSE, ARCH) Offered by the CE Dept

6.1.1 Interdisciplinary Courses offered to PME Dept

COURSE INFORMATION			
Course Code Course Title	: CE 281 : Engineering Mechanics	Lecture contact hours Credit hours	: 3.00 : 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			
• 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. • To apprehend the problems involving friction and their real application (in a limited scale) • To determine geometric properties like centroids of line, area and volume, Theorems of Pappus and Guldinus, Centre of pressure along with internal properties of object such as Rectangular and Polar Moment of Inertia and Radius of gyration of single and composite areas, Transfer formula, Product of Inertia, Moment of Inertia at inclined axis, maximum and minimum moment of inertia, Moment of Inertia of Masses. • Solve different problems with the concept of linear Impulse and Momentum.			
COURSE CONTENT (2021)			
Concurrent / coplanar / non-coplanar force systems; Resultant of forces, Resolution of forces, Rectangular components of forces in plane; Concept of Free body diagram; Equation of static equilibrium; Support Reactions, Internal Force and Moment; Equivalent force system.; Analysis of 2D Frame; Analysis of 2D Truss; Friction; Centroid and Center of Gravity: Line, Area, Volume, Composite bodies; Moment of inertia of area, masses; Parallel axis theorem; Principle of Impulse and Momentum; Principle of work and energy. Plane Motion, Rectilinear motion.			

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	To **understand** free body diagram of different types of rigid bodies.	√											
2	To **apply** equations of equilibrium to analyze statically determinate rigid bodies.		√										
3	To **estimate** the geometric properties like centroids, moment of inertia etc. of different objects.	√											
4	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	To **understand** free body diagram of different types of rigid bodies.	1	C2	1	-	3	Class Test/ Assignment
CO2	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	To **estimate** the geometric properties like centroids, moment of inertia etc. of different objects.	1	C3	1	-	3, 4	Class Test/ Assignment/ Mid-term/ Pop quiz/ Final Exam
CO4	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 learning) Preparation for tests and examination	33 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	Topics	Assessments
1	Resultant and Components of Forces	Assignment, Class Test, Mid-term, Pop quiz, Final Exam
	Types of Forces and Introduction to Coplanar Concurrent Forces	
	Centroids: Definitions of centroids, centre of mass and centre of gravity, Formulas of centroids for line, area and volume.	
2	Concept of Equilibrium	
	Free Body Diagrams	
	Principle of symmetry and centroid, centroid by summation method	
3	Introduction to Truss	
	Analysis of Truss by joint Method	
	Centroid by Integration, practice centroid of lines by integration.	
4	Analysis of Truss by Joint-to-Joint Method	
	Tutorial 1(on Forces, Resultant and Components)	
	Centroid of Arc of a Circle, Centroid of plane triangle, Centroid of sector of a circle, Centroid of area without axis of symmetry.	

5	Tutorial on Analysis of Truss/Frames	
	Concept of Moments	
	Centroid of a volume (right circle cone, cylinder, hemisphere etc.)	
6	Concept of Parallel Force System	
	Determination of Reaction Forces, Forces on Members of Frames	
	Centroid of composite area, Centroid of composite volume	
7	Tutorial on Determination of Reaction Forces, Forces on Members of Frames	
	Tutorial on Determination of Reaction Forces, Forces on Members of Frames	
	Theorem of Pappus and Guldinus, Center of Pressure	
8	Non-Concurrent, Non – Parallel, Coplanar Forces	
	Analysis of Truss by Method of Section	
	Practice problem related to Theorem of Pappus and Guldinus, Center of Pressure	
9	Concept of Rectangular and Polar moment of Area and radius of gyration, Parallel axis and perpendicular axis theorem (Transfer formula, rectangular to polar)	
	Tutorial on Analysis of Truss by Method of Section	
	Practice problems of Rectangular Moment of Inertia and radius of gyration with axis of symmetry (Rectangle, triangle etc)	
10	Tutorial on Non-Concurrent, Non – Parallel, Coplanar Forces	
	Practice problems of Rectangular Moment of Inertia and radius of gyration with axis of symmetry (Rectangle, triangle etc)	
	Maximum and Minimum Moment of Inertia by formula and Mohr’s circle	
11	Formula and practice problems (solid cylinder) for Moment of Inertia of Masses and radius of Gyration.	
	Concept of Friction and Belt Friction	
	Moment of Inertia about Inclined Axis, Product of Inertia	
12	Analysis of Wedges	
	Tutorial on problems associated with Friction	
	Moment of Inertia of Composite areas	
13	Tutorial on Friction and Belt Friction	
	Moment of inertia of mass and practice problems (Sphere, thin disk, cone)	
	Moment of inertia of mass and practice problems (Sphere, thin disk, cone)	
14	Problem solving on Wedges	
	Moment of Inertia of masses of composite bodies	
	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, CO4	C3
Total Marks	100%		

REFERENCE BOOKS

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

COURSE INFORMATION			
Course Code Course Title	: CE 283 : Mechanics of Solids II	Lecture contact hours Credit hours	: 3.00 : 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
In this course students will be able to gain fundamental knowledge on stress, strain, deformation, behaviour of beams and columns subjected to various loading.			
OBJECTIVE			
• To gain knowledge about the effect (state of stress) on beam due to combined loading and the transformation stresses and construction Mohr's circles of stress, subsequently understand the failure criteria by different theories of failure • To understand Euler's buckling theory and its application in compressive members. • To compute the deflection of beam by various methods. • To develop the concept of strain energy for axial stress, flexural stress and shear stress. • To understand the behavior of cable under uniformly distributed load and concentrated load.			
COURSE CONTENT (2021)			
Introduction, Simple Stress and Strain, Stress-strain diagram, Elasticity and elastic limits. Modulus of Elasticity and Rigidity: Definition of some mechanical properties of materials, Poission's ratio, Volumetric strain and bulk modulus. Relation between modulus of elasticity and bulk modulus, Relation between modulus of rigidity and modulus of elasticity. Internal forces: Axial (Tension, Compression), Shear force, Bending Moment and Torsion. Deformations due to tension, compression and temperature change Statically Determinate Beams: Introduction, Different types of loading and supports, Shear force and bending moment diagram, Torsion: Torsion formula, Angle of twist of solid and hollow shaft, Torsional stiffness and equivalent shaft, closely coiled helical spring. Bending stress of beam, Shear Stress of beam, Stresses in thin-walled pressure vessels, Economic sections. Deflection of beams, Elastic curve, Method of double integration, Area moment. Shearing stress and deflection in composite beams. Combined Stresses and Strains: Principal stresses and principal planes, Combined axial and bending stresses, Stress at a point, Stress on inclined cutting planes, Analytical method for the determination of stresses on oblique section, Mohr's circle, Application of Mohr's circle to combined loading. Transformation of strain components. Column Theory: Introduction to elastic stability, Euler's formula for central load and different end conditions, Modes of failure and critical load, Slenderness ratio and classification of columns, Empirical formula for columns, secant formula for columns with eccentric loading.			

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	To **understand** the stress and elastic strain energy under different loading (normal, shear, torsion etc).	√											
2	To **solve** the flexible cord, cable and cable supported structure.	√											
3	To **determine** the deflection and rotation of flexural member.	√											
4	To **understand** the fundamental buckling phenomena of axially loaded members.		√										

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	To **understand** the stress and elastic strain energy under different loading (normal, shear, torsion etc).	1	C2	1	-	3	Class Test/ Assignment/ Mid-term/ Pop quiz/ Final Exam
CO2	To **solve** the flexible cord, cable and cable supported structure.	1	C3	1	-	3, 4	Class Test/ Final Exam
CO3	To **determine** the deflection and rotation of flexural member.	1	C3	1	-	3, 4	Class Test/ Assignment/ Mid-term/ Pop quiz/ Final Exam

CO4	To **understand** the fundamental buckling phenomena of axially loaded members.	2	C2	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 learning) Preparation for tests and examination	33 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

<table>
<tr><th>Week</th><th>Lecture</th><th>Topics</th><th>Assessments</th></tr>
<tr><td rowspan="3">1</td><td>1</td><td>Introduction and fundamentals of mechanics and mechanics of solids, Discussion on syllabus etc</td><td rowspan="6">Class Test, Mid-term, Pop quiz, Assignment,Final Exam</td></tr>
<tr><td>2</td><td>Elastic strain energy and external work</td></tr>
<tr><td>3</td><td>Deflection of beam: Derivation of 2nd and 4th order differential equation of deflection of beam(direct integration method)</td></tr>
<tr><td rowspan="3">2</td><td>4</td><td rowspan="2">Elastic strain energy and external work</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td><td>Deflection of beam using direct integration method:</td></tr>
</table>

		Simply supported with point loading, discontinuous UDL, Concentrated moment	
3	7 8	Beam deflection examples	
	9	Unsymmetric (Skew) Bending of Beam	
4	10	Unsymmetric (Skew) Bending of Beam	
	11	Deflection of beam using moment area method	
	12	Beam deflection examples	
5	13	Deflection of beam using moment area method	
	14		
	15	Unsymmetric (Skew) Bending of Beam	
6	16	Introduction to Buckling of column, related definitions and concepts. Derivation of Euler's Load for columns with pin ends. Euler Load for columns with different end restraints.	
	17	Flexible chords	
	18		
7	19	Euler Formula and buckling of columns	
	20		
	21	Cable theorem	
8	22	Euler Formula and buckling of columns	
	23		
	24	Cable and cable supported structures	
9	25 26	Basic concept of transformation of stress. Transformation of stresses in 2D problems, Principal stresses in 2D problems, Maximum shear stresses in 2D problems	
	27	Cable theorem; cable and cable supported structures	
10	28	Examples of Transformation of stress	
	29	Elastic analysis of circular shafts subjected to torsion	
	30		
11	31	Mohr's circle of stresses	
	32	Elastic analysis of circular shafts subjected to torsion	
	33		
12	34	Mohr's circle of stresses	
	35	Solid non-circular subjected to torsion	
	36		
13	37	Mohr's circle of stresses	
	38	Thin-walled tubular members subjected to torsion	
	39		

14	40	Mohr's circle of stresses	
	41	Combination of composite-shape members subjected to torsion	
	42	Discussion	

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%	CO1, CO2, CO3, CO4	C2, C3
Total Marks	100%		

REFERENCE BOOKS

1. "Engineering Mechanics of Solids" by –Egor P. Popov (2nd Edition)
2. "Mechanics of Materials" by – Beer, Johnston and Dewolf (4th Edition)
3. "Mechanics of Materials" by – R.C. Hibbeler (7th Edition)
4. "Mechanics of Materials" by – Ferdinand L. Singer and Andrew Pytel (4th Edition)
5. "Strength of Materials" by – W A nash (4th Edition)

6.1.2 Interdisciplinary Courses offered to ARCH Dept

COURSE INFORMATION

Course Code	: CE 2121	Lecture contact hours	: 2.00
Course Title	: Structure I: Mechanics	Credit hours	: 2.00

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 as well as engineering materials which will be helpful for their future study/courses.

OBJECTIVE

- 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.
- To determine geometric properties like centroids of line, area and volume, moment of inertia
- To investigate various properties of materials; steel, timber and concrete.

COURSE CONTENT

Force System; Resultants and Components; Concept of Free Body Diagram; Equation for Static Equilibrium; Coplanar Con-Current Forces; Moments of Coplanar Forces; Centroid; Moment of Inertia of Areas; Fundamental Concepts of Stress and Strain; Mechanical Properties of Materials; Steel, Timber and Concrete.

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	Ability to **understand** free body diagram of different types of rigid bodies.	√											
2	Ability to **apply** equations of equilibrium to analyze statically determinate rigid bodies.		√										

3	Ability to **estimate** the geometric properties like centroids, moment of inertia etc. of different objects.	√											
4	Ability to **understand** the basic properties of engineering materials	√											

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, moment of inertia etc. of different objects.	1	C3	1	-	3, 4	Class Test/ Assignment/ Mid-term/ Pop quiz/ Final Exam
CO4	Ability to **understand** the basic properties of engineering materials.	1	C2	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)	28
Guided Learning Tutorial/ Assignments (3 hours/week x 5 weeks)	10
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	18 18
Assessment Continuous Assessment Final examination	3 3
Total	80
TEACHING METHODOLOGY	
Lecture and Discussion, Problem Based Learning (PBL)	
TEACHING SCHEDULE	

Week	Topics	Assessments
1	Force System	CT, Final Exam
	Centroid	
2	Resultants and Components	
	Centroid	
3	Resultants and Components	
	Centroid	
4	Resultants and Components	
	Centroid	
5	Equation for Static Equilibrium	Mid Term, Final Exam
	Moment of Inertia of Areas	
6	Concept of Free Body Diagram;	
	Moment of Inertia of Areas	
7	Equation for Static Equilibrium	
	Moment of Inertia of Areas	
8	Equation for Static Equilibrium	

	Moment of Inertia of Areas	
9	Equation for Static Equilibrium	CT, Final Exam
	Fundamental Concepts of Stress and Strain	
10	Coplanar Con-Current Forces; Moments of Coplanar Forces	
	Fundamental Concepts of Stress and Strain	
11	Coplanar Con-Current Forces; Moments of Coplanar Forces	
	Fundamental Concepts of Stress and Strain	
12	Coplanar Con-Current Forces; Moments of Coplanar Forces	
	Fundamental Concepts of Stress and Strain	
13	Coplanar Con-Current Forces; Moments of Coplanar Forces	Final Exam
	Mechanical Properties of Materials; Steel, Timber and Concrete	
14	Coplanar Con-Current Forces; Moments of Coplanar Forces	
	Mechanical Properties of Materials; Steel, Timber and Concrete	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3
Final Exam	60%	CO 1	C2
		CO 2	C3
		CO 3	C3
		CO 4	C2
Total Marks	100%		

REFERENCE BOOKS

1. Analytic Mechanics by – Faires & Chambers (3rd Edition)
2. Engineering Mechanics of Solids by – Popov
3. Strength of Materials by – Andrew Pytel, Ferdinand L. Singer (4 th Edition)

COURSE INFORMATION			
Course Code Course Title	: CE 2221 : Structure II: Basic Mechanics of Solids	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
In this course students will be able to gain fundamental knowledge on stress, strain, deformation, behaviour of beams and truss subjected to various loading.

OBJECTIVE

- To determine the shear force and bending moment diagram for statically determinate beams and frames
- To gain knowledge about the effect (state of stress) on beam due to combined loading and the transformation stresses and construction Mohr's circles of stress, subsequently understand the failure criteria by different theories of failure
- To compute the deflection of beam by various methods.
- To develop the concept of strain energy for axial stress, flexural stress and shear stress.
- To determine the member force of truss

COURSE CONTENT (2021)
Stresses and strains in members subjected to tension, compression, shear and temperature changes; Shear force and bending moment diagrams for statically determinate beams and frames; Flexural and shearing stresses in beams; Deflection in statically determinate beams by Area-Moment method; Truss Analysis.

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	**Determine** shear force and bending moment diagram for statically determinate beams and frames.	√											
2	**Understand** the stress and elastic strain energy under different loading (normal, shear, torsion etc).	√											

3	**Determine** the deflection and rotation of flexural member.	√											
4	**Determine** the member force of truss.		√										

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Determine** shear force and bending moment diagram for statically determinate beams and frames	1	C2	1	-	3	Class Test/ Assignment/ Mid-term/ Pop quiz/ Final Exam
CO2	**Understand** the stress and elastic strain energy under different loading (normal, shear, torsion etc)	1	C3	1	-	3, 4	Class Test/ Final Exam
CO3	**Determine** the deflection and rotation of flexural member	1	C3	1	-	3, 4	Class Test/ Assignment/ Mid-term/ Pop quiz/ Final Exam
CO4	**Determine** the member force of truss	2	C2	1	-	3	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	28

(4 hours/week x 14 weeks)	
Guided Learning Tutorial/ Assignments (4 hours/week x 5 weeks)	10
Independent Learning Individual learning (1 hour lecture ≈1.0 hour learning) Preparation for tests and examination	18 18
Assessment Pop Quiz/Class Test/Mid-Term Exam Final examination	3 3
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Stresses and strains in members subjected to tension, compression, shear and temperature changes	CT, Final Exam
	2	Flexural and shearing stresses in beams	
2	3	Stresses and strains in members subjected to tension, compression, shear and temperature changes	
	4	Flexural and shearing stresses in beams	
3	5	Stresses and strains in members subjected to tension, compression, shear and temperature changes	
	6	Flexural and shearing stresses in beams	
4	7	Stresses and strains in members subjected to tension, compression, shear and temperature changes	
	8	Flexural and shearing stresses in beams	
5	9	Stresses and strains in members subjected to tension, compression, shear and temperature changes	Mid Term, Final Exam
	10	Flexural and shearing stresses in beams	
6	11	Stresses and strains in members subjected to tension, compression, shear and temperature changes	
	12	Deflection in statically determinate beams by Area-Moment method	

7	13	Shear force and bending moment diagrams for statically determinate beams and frames	
	14	Deflection in statically determinate beams by Area-Moment method	
8	15	Shear force and bending moment diagrams for statically determinate beams and frames	
	16	Deflection in statically determinate beams by Area-Moment method	
9	17- 18	Deflection in statically determinate beams by Area-Moment method	CT, Final Exam
10	19	Shear force and bending moment diagrams for statically determinate beams and frames	
	20	Deflection in statically determinate beams by Area-Moment method	
11	21	Shear force and bending moment diagrams for statically determinate beams and frames	
	22	Truss Analysis	
12	23	Shear force and bending moment diagrams for statically determinate beams and frames	
	24	Truss Analysis	
13	25	Shear force and bending moment diagrams for statically determinate beams and frames	Final Exam
	26	Truss Analysis	
14	27	Shear force and bending moment diagrams for statically determinate beams and frames	
	28	Truss Analysis	

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%	CO1, CO2, CO3, CO4	C2, C3
Total Marks	100%		
REFERENCE BOOKS			
1. Engineering Mechanics of Solids by – Popov 2. Theory and Problems of Strength of Materials by -William A Nash 3. Strength of Materials by – Andrew Pytel, Ferdinand L. Singer (4th Edition)			

COURSE INFORMATION			
Course Code Course Title	: CE 3121 : Design of Concrete Structures I	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE
None
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
In this course students will learn about concepts of reinforced concrete structure and able to design reinforced concrete beam and slab. Students will also be introduced with the behaviour of the column, shear wall and earthquake resisting system which will be beneficial for their future development and professionalism.
OBJECTIVE
• To gain knowledge on the basics of reinforced concrete structure. • To be able to design beam, slab and column using USD method. • To become aware about the safety and serviceability of reinforced concrete structures under earthquake load.
COURSE CONTENT (2021)
Fundamentals of reinforced concrete design; Concrete and its effective preparation; Concepts of WSD and USD methods; Analysis and design of reinforced beams by USD; Design of slabs, one way and two ways; reinforced concrete columns and buckling; Introduction to Shear-walls, earthquake resistant structural 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 concepts of reinforced concrete and its preparations.	√											
2	**Analyze** the capacity of structural elements against applied load considering the given material property.		√										
3	**Design** different structural elements ie beams, column, slabs.			√									

4	**Understand** the concepts of earthquake resistant structural system.	√											

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** the concepts of reinforced concrete and its preparations.	1	C2	1	-	3,4	Pop Quiz/Mid-term/ Final Exam
CO2	**Analyze** the capacity of structural member against applied load considering the given material property.	2	C4	1	-	4	Class Test/ Mid-term/ Final Exam
CO3	**Design** different structural elements ie beam, column and slabs etc.	3	C3	1	-	5	Mid-term/ Pop quiz/ Final Exam
CO4	**Understand** the concepts of earthquake resistant structural system.	1	C2	1	-	3,4	Class Test/Mid-term/ Final Exam

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

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face to Face Learning Lecture (3 hours/week x 14 weeks)	28
Guided Learning Tutorial/ Assignments (3 hours/week x 5 weeks)	12
Independent Learning	20

Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	15
Assessment Continuous Assessment Final examination	 2 3
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Introduction to Concrete, Reinforced Concrete	Pop Quiz/ Assignment/ Final Exam
	2	Introduction fundamental design concepts of reinforced concrete and its preparation.	
2	3	Introduction to WSD and UDS methods.	
	4	Fundamental assumption of RC concrete.	
3	5	Math	
	6	Materials, properties under compression, shrinkage, temperature, stress strain curve, relaxation etc.	
4	7	Flexural analysis and design of beam, bending of homogenous beam	CT/ Assignment/ Final Exam
	8	RC concrete beam behaviour.	
5	9	Analysis of beam (Example)	
	10	Analysis for beam (Example)	
6	11	Design of Beam (Example)	Mid Term/ Assignment Final Exam
	12	Design of beam (Example)	
7	13	Introduction to slab System	
	14	Analysis and design of slab, design of one-way slab.	
8	15	Temperature shrinkage reinforcement, Design example of one-way slab.	

	16	Design example and detailing of one-way slab.	
9	17	Behavior of two-way edge supported slab, column supported slab.	
	18	Design procedure of slab using various methods.	
10	19	Introduction to moment coefficient method	
	20	Design example of two-way slab using moment coefficient method.	
11	21	Design example of two way slab using moment coefficient method.	
	22	Introduction to column	
12	23	Buckiling of Column.	CT/ Assignment Final Exam
	24	Example (Math column)	
13	25	Introduction to shear wall	
	26	Math Shear Wall	
14	27	Introduction to Earthquake Resisting system	
	28	Introduction to Earthquake Resisting system	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C3, C4
Final Exam	60%	CO 1	C2
		CO 2	C4
		CO 3	C3
		CO4	C2
Total Marks	100%		

REFERENCE BOOKS

1. Reinforced Concrete: Mechanics and Design (6th Edi) by James Wight and James MacGregor
2. “Design of Concrete Structures” by – Nilson (12th Edition)
3. “Design of Concrete Structures” by – Nilson, David & Dolan (15th Edition)
4. Structural Design Guide to the ACI Building Code (3rd Edition) - Rice, Hoffman, Gustafson, Gouwens
5. Bangladesh National Building Code (Latest Version)

COURSE INFORMATION			
Course Code Course Title	: CE 3221 : Structure IV: Elements of Building and large Span structures	Lecture contact hours Credit hours	: 2.00 : 2.00

PRE-REQUISITE
None
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
In this course students will be introduced with components of different civil engineering structures. This hand on training will be useful for the students in later projects.
OBJECTIVE
• To impart knowledge on the basics of different types of components of a building, design loads, framed structure and load bearing wall structure. • To make the students efficient in practical field through rigorous theoretical lessons and practical problem solving.
COURSE CONTENT
Approximate analysis of multistoried buildings for gravity and lateral loads. Simple analysis of Truss Sections; analysis and preliminary design of steel beams and columns; Introduction to various structural forms and systems; Types of Foundations; Concepts of bearing capacity and settlement and Pilling.

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** fundamental design concepts of reinforced concrete and steel structure	√											
2	**Analyze** the capacity of structural member against applied load considering the given material property.		√										

3	**Design** different structural elements ie beams, columns for design loads			√									

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** fundamental design concepts of reinforced concrete and steel structure	1	C2	1	-	3, 4	Class Test, Mid Term, Final and class participation
CO2	**Analyze** the capacity of structural member against applied load considering the given material property.	2	C4	1	-	4	Class Test, Mid Term, Final and class participation
CO3	**Design** different structural elements ie beams, columns for design loads	3	C3	1	-	5	Class Test, Mid Term, Final and class participation

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	24

Individual learning (1 hour lecture ≈ 1 hour learning) Preparation for tests and examination	13
Assessment Pop Quiz/Class Test/Mid-Term Exam Final examination	 03 02
Total	80

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	**Topics**	**Assessments**
1	Approximate analysis of multistoried buildings for gravity and lateral loads	Pop Quiz/Class Test/Mid-Term Exam/ Final Exam
2	Approximate analysis of multistoried buildings for gravity and lateral loads	
3	Simple analysis of Truss Sections	
4	Simple analysis of Truss Sections	
5	Simple analysis of Truss Sections	
6	Analysis and preliminary design of steel beams	
7	Analysis and preliminary design of steel beams	
8	Analysis and preliminary design of steel columns	
9	Analysis and preliminary design of steel columns	
10	Introduction to various structural forms	
11	Introduction to various structural systems	
12	Types of Foundations	
13	Concepts of bearing capacity	
14	Concepts of settlement and pilling	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous assessment	40%	CO1, CO2, CO3	C2, C3, C4
Final examination	60%	CO 1	C2
		CO 2	C4

		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS
1. Structural Design Guide to the ACI Building Code (3rd Edition) - Rice, Hoffman, Gustafson, Gouwens 2. Steel Structures: Design and Behavior by Salmon, Johnson and Malhas (5th Edition) 3. Bangladesh National Building Code (Latest Version)

COURSE INFORMATION

Course Code	: CE 4261	Lecture contact hours	: 2.00
Course Title	: Survey Techniques	Credit hours	: 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course is designed to learn different types of survey techniques and how to conduct them. In this course, students will also be learnt different processes of data collection for conducting a survey and how to present them. They will also be introduced how to write research paper and how to present data collecting from survey.

OBJECTIVE

- To develop a deep understanding on techniques, skills and modern tools necessary for surveying.
- To understand the background concept of contour map production.
- To know research methodology and writing techniques of research paper.

COURSE CONTENT

Introduction to surveying- principles and techniques of physical surveys. Chain survey, traverse survey, plane table survey, levels and levelling, contours and layout surveys. Research and its types. Design and plan of research-purpose and goal, variables and universal, selection of methods. Design of questionnaire, pre-test, pilot survey. Collection and filling of data. Data processing.

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	Ability to **understand** the working principles of various survey methods, equipment and tools for conducting different types of surveying	√											
2	Ability to **apply** different survey methods in solving engineering problems			√									

3	Ability to **know** research methodology and writing techniques of research paper	√											

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** the working principles of various survey methods, equipment and tools for conducting different types of surveying	1	C2	1	-	1,2	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **apply** different survey methods in solving engineering problems	2	C3	3	-	3, 4	Class Test, Mid-term, Pop quiz, Final Exam
CO3	Ability to **produce** steel structural drawings as per code with proper detailing for construction.	1	C2	1	-	1,2	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 (3 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 learning)	18 18

Preparation for tests and examination	
Assessment Continuous Assessment Final examination	 3 3
Total	80
TEACHING METHODOLOGY	
Lecture and Discussion, Problem Based Learning (PBL)	
TEACHING SCHEDULE	

Week	Lecture	Topics	Assessments
1	1	Introduction to surveying- principles and techniques of physical surveys.	CT, Final Exam
	2		
2	3	Chain survey	
	4	Chain survey	
3	5	Chain survey	
	6	Traverse survey	
4	7	Traverse survey	
	8	Traverse survey	
5	9	Traverse survey	Mid Term, Final Exam
	10	Plane table survey	
6	11	Plane table survey	
	12	Plane table survey	
7	13	Levels and levelling	
	14	Levels and levelling	
8	15	Levels and levelling	
	16	Levels and levelling	
9	17	Contours and layout surveys	CT, Final Exam
	18	Contours and layout surveys	
10	19	Research and its types	
	20	Research and its types	
11	21	Research and its types	

	22	Design and plan of research-purpose and goal, variables and universal, selection of methods	
12	23	Design and plan of research-purpose and goal, variables and universal, selection of methods	
	24	Design and plan of research-purpose and goal, variables and universal, selection of methods	
13	25	Design of questionnaire, pretest, pilot survey	Final Exam
	26	Design of questionnaire, pretest, pilot survey	
14	27	Collection and filing of data. Data processing	
	28	Collection and filing of data. Data processing	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO2, CO3	C2, C3, C4
Final Exam	60%	CO 1	C2
		CO 2	C3
		CO 3	C2
Total Marks	100%		

REFERENCE BOOKS

1. Surveying VOL-I by Dr. B.C Punmia, Ashok K. Jain and Arun K. Jain
2. Surveying VOL-II by Dr. B.C Punmia, Ashok K. Jain and Arun K. Jain

6.1.3 Interdisciplinary Courses offered to EWCE Dept

COURSE INFORMATION			
Course Code Course Title	: CE 385 : Design of Concrete Structures I	Lecture contact hours Credit hours	: 3.00 : 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

In this course students will learn to design different types of reinforced concrete slab and beam under flexural and shear loading and to develop a strong foundation and design concepts of reinforced concrete building which will be beneficial for their future development and professionalism.

OBJECTIVE

- To gain knowledge on the basics of reinforced concrete structure.
- To be able to design beam, slab and web reinforcement for beam.
- To become aware of the proper safety and serviceability of reinforced concrete structures.

COURSE CONTENT (2021)

Fundamental behavior of reinforced concrete and loads on structure; introduction to strength and serviceability design and alternative 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 of reinforcement and its detailing. Introduction to floor systems; structural forms, Design of one-way slabs; design of two-way edge supported slabs: using strip and alternate methods.

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** fundamental design concepts of reinforced concrete	√											
2	**Analyze** the capacity of structural member against applied load		√										

	considering the given material property.												
3	**Design** different structural elements ie slabs, beams for flexure and shear using code provisions			√									

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** fundamental design concepts of reinforced concrete	1	C2	1	-	3,4	Class Test/ Mid-term/ Final Exam
CO2	**Analyze** the capacity of structural member against applied load considering the given material property.	2	C4	1	-	4	Class Test/ Mid-term/ Final Exam
CO3	**Design** different structural elements ie slabs, beams for flexure and shear using code provisions	3	C3	1	-	5	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)	18
Independent Learning	

Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	33 22
Assessment Continuous Assessment Final examination	 2 3
Total	120

TEACHING METHODOLOGY
Lecture and Discussion, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Introduction to Concrete, Reinforced Concrete and prestressed concrete, load according to BNBC	Class Test, Mid-term, Pop quiz, Final Exam
	2	Introduction to strength design and alternate design methods;	
	3	Safety provision of ACI Code, serviceability.	
2	4	Fundamental assumption of RC concrete, Behavior under axial load	
	5	Design example.	
	6	Materials, properties under compression, shrinkage, temperature, stress strain curve, relaxation etc.	
3	7	Flexural analysis and design of beam, bending of homogenous beam	
	8	RC concrete beam behavior.	
	9	Design example.	
4	10	Design of tension reinforced rectangular beam, ACI Code Provisions	
	11	Under-reinforced, over-reinforced beam, minimum reinforcement ratio.	
	12	Design of Singly reinforced beam	
5	13	Design example of singly reinforced beam	
	14	Design aid, Practical consideration in the design of beam,	
	15	Rectangular beam with tension and compression.	

6	16	Doubly Reinforced beam analysis	
	17	Design example of doubly reinforced beam.	
	18	Design example of doubly reinforced beam.	
7	19	T-beam analysis	
	20	Effective flange width, strength analysis.	
	21	T-beam design example	
8	22	T-beam design example	
	23	Shear and diagonal tension in beams**.** Diagonal tension in homogenous elastic beams	
	24	Reinforced concrete beam without shear reinforcement	
9	25	ACI code provision for shear design	
	26	Design Example.	
	27	Design of web reinforcement.	
10	28	Design problems.	
	29	Analysis and design of slab, design of one way slab.	
	30	Temperature shrinkage reinforcement, Design example of one way slab.	
11	31	Design example and detailing of one way slab.	
	32	Behavior of two way edge supported slab, column supported slab.	
	33	Design procedure of slab using various methods.	
12	34	Introduction to moment coefficient method	
	35	Design example of two way slab using moment coefficient method.	
	36	Design example of two way slab using moment coefficient method.	
13	37	Design example of two way slab using moment coefficient method.	
	38	Design and reinforcement detailing of two way slab.	
	39	Bond and anchorage and Development length, fundamental of flexural bond.	

14	40	Bond strength and development length, anchorage requirement for web RCC.	
	41	Bar cut-off and bent point of beams, Bar splices.	
	42	Design example of development length.	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3	C2, C3, C4
Final Exam	60%	CO 1	C2
		CO 2	C4
		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS

1. Reinforced Concrete: Mechanics and Design (6th Edi) by James Wight and James MacGregor
2. “Design of Concrete Structures” by – Nilson (12th Edition)
3. “Design of Concrete Structures” by – Nilson, David & Dolan (14th Edition)
4. Structural Design Guide to the ACI Building Code (3rd Edition) - Rice, Hoffman, Gustafson, Gouwens
5. Bangladesh National Building Code (Latest Version)

COURSE INFORMATION			
Course Code Course Title	: CE 386 : Concrete Structures Design Sessional I	Lecture contact hours Credit hours	: 3.00 : 1.50

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This is the class room design sessional where students will be guided to design and prepare detailing of different components of a low-rise masonry structure, slab bridge and balanced cantilever bridge.

OBJECTIVE

- To design a reinforced concrete low-rise building.
- To design slab bridge and balanced cantilever bridge in real time project.
- To identify, formulate and solve real time RCC structures.

COURSE CONTENT (2021)

Design and Detailing of Low-rise masonry building as per BNBC; Design of Slab Bridge; Design of Balanced Cantilever Bridge (AASHTO LRFD 2012).

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 fundamentals design concepts of building and Bridges.	√											
2	**Design** different elements of a low-rise masonry building.			√									
3	**Design** of various structural components of a slab bridge and a balanced cantilever bridge.			√									

COURSE OUTCOMES AND GENERIC SKILLS							
No.	Course Outcomes	Corresponding POs	Bloom’ s Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** the fundamentals design concepts of building and Bridges.	1	C2	-	1	4, 5	Quiz/ Report/ Assignments/ Presentation
CO2	**Design** different elements of a low-rise masonry building.	3	C3	-	1	5	
CO3	**Design** of various structural components of a slab bridge and a balanced cantilever bridge.	3	C3	-	1	5	
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 12 weeks)	36
Guided Learning Report Writing (1 hours/week x 12 weeks)	12
Independent Learning Individual learning (1-hour lecture ≈ 1-hour learning) Preparation for tests and examination	3 3
Assessment Continuous Assessment Quiz	3 3
Total	60

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

TEACHING SCHEDULE

Week	Topics	Assessments
1.	Introduction to the design of a masonry building following BNBC guidelines and design of slab of a low rise masonry building.	Viva, quiz, Presentation
2.	Design of beam	
3.	Design of stair	
4.	Design of sunshade and lintel	
5.	Design of foundation	
6.	**Mid Quiz**	
7.	Introduction on bridge design and Design of Slab Bridge with detailing	
8.	Introduction to the design of a balanced cantilever bridge. Design of deck slab and railing of a balanced cantilever bridge.	
9.	Analysis of Interior Girder for dead loads and live loads	
10.	Analysis of Interior Girder for dead loads and live loads	
11.	Design of Interior girder	
12.	Design of Exterior girder and diaphragm	
13.	Design of articulation.	
14.	**Viva/ Oral Presentation/Final Quiz**	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Continuous Assessment (Class performance/assignments/ Report writing/ Presentation/Viva)	50%	CO1, CO2, CO3	C2, C3
Quiz	50%	CO 1	C2
		CO 2	C3

		CO 3	C3
Total Marks	100%		

REFERENCE BOOKS
1. Design of Concrete Structures by Nilson (10th, 12th and 14th Edition) 2. Bangladesh National Building Code (BNBC) - 2012 3. AASHTO LRFD Bridge: Design Specifications 2012

COURSE INFORMATION

Course Code	: CE 387	Lecture contact hours	: 3.00
Course Title	: Design of Concrete Structures II	Credit hours	: 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

In this course students will learn to design various components of reinforced concrete building, such as short column, slender column, footing, pile caps, retaining wall, shear wall, etc and to develop a strong foundation and concepts of seismic resistant building and pre-stressed concrete which will be beneficial for their future development and professionalism.

OBJECTIVE

- To develop a strong foundation on reinforced concrete structure maintaining proper safety and serviceability requirement.
- To be able to design various components of reinforced concrete structure, specially focusing on short column, slender column, footing, pile caps, retaining wall, shear wall etc.
- To understand the basic concepts of pre-stressed concrete.
- To be able to analyse pre-stressed concrete beam

COURSE CONTENT (2021)

Introduction to floor systems and design of column supported slabs (flat plates, detailing of flat plate, direct design method); design of columns under uniaxial and biaxial loading, introduction to slender column; seismic detailing; structural design of footings, pile caps; design of RCC shear wall.

Prestressed Concrete: concepts of prestressing; materials; anchorage systems; Analysis and preliminary design of prestressed concrete beam.

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** fundamental design concepts of reinforced concrete and pre-stressed concrete.	√											

2	**Design** structural components of a reinforced concrete building.			√									
3	**Understand** considerations and criteria of seismic resistant building.	√											
4	**Analyse** pre-stressed concrete beam.			√									

COURSE OUTCOMES AND GENERIC SKILLS

No.	Course Outcomes	Corresponding POs	Bloom's Taxonomy	CP(WP)	CA(EA)	KP(WK)	Assessment Methods
CO1	**Understand** fundamental design concepts of reinforced concrete and pre-stressed concrete structures.	1	C2	1	-	3, 4	Pop quiz, Final Exam
CO2	**Design** structural components of a reinforced concrete building.	3	C3	1	-	5	Class Test, Mid-term, Pop quiz, Final Exam
CO3	**Understand** considerations and criteria of seismic resistant building.	1	C2	1	-	4	Class Test, Pop quiz, Final Exam
CO4	**Analyse** pre-stressed concrete beam.	3	C4	1	-	5	Assignments,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, Problem Based Learning (PBL)

TEACHING SCHEDULE

Week	Lecture	Topics	Assessments
1	1	Course overview & Fundamental behavior of reinforced concrete column	Class Test, Mid-term, Pop quiz, Assignment,Final Exam
	2	Introduction to axial compression	
	3	Structural design of footings	
2	4	Compression plus bending of rectangular columns & Interaction diagrams	
	5		
	6	Structural design of footings	
3	7	Compression plus bending of rectangular columns & Interaction diagrams and Balanced failure	
	8	Structural design of footings	
	9	Structural design of pile caps	
4	10	Distributed reinforcement and Circular column	
	11	Structural design of pile caps	
	12	Structural design of pile caps	
5	13	ACI code provisions for column design and Design aids	
	14		
	15	Design of RCC shear wall.	
6	16	Biaxial bending	
	17	Design of RCC shear wall.	
	18	Design of RCC shear wall.	

7	19	Biaxial bending	
	20		
	21	Seismic detailing.	
8	22	Slender columns	
	23		
	24	Seismic detailing.	
9	25	Slender columns	
	26	Introduction to Pre-stressed Concrete	
	27	1st Concept of pre-stressing	
10	28	2nd Concept of pre-stressing	
	29	3rd Concept of pre-stressing	
	30	Type and Classification of Pre-stressing	
11	31	Introduction to floor systems, Design of column supported slabs	
	32	Stages of Loading in Pre-stressed Concrete Beam	
	33	Pre-stressed Concrete materials and anchorage systems.	
12	34	Design of column supported slabs	
	35	Pre-stressed Concrete materials and anchorage systems.	
	36	Pre-stressed Concrete materials and anchorage systems.	
13	37	Design of column supported slabs	
	38	Losses of Pre-stressed Concrete	
	39	Analysis of pre-stressed concrete beam.	
14	40	Analysis of pre-stressed concrete beam	
	41	Preliminary Design of pre-stressed concrete beam.	
	42	Preliminary Design of pre-stressed concrete beam.	

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (Class assignments/ CT/ Mid Term/ Active Class Participation)	40%	CO1, CO2, CO3, CO4	C2, C3, C4
Final Exam	60%	CO 1	C2
		CO 2	C3
		CO 3	C2

		CO 4	C4
Total Marks	100%		
REFERENCE BOOKS			
1. Design of Concrete Structures – Nilson, 12th Ed. 2. Design of Concrete Structures – Nilson, David & Dolan, 15th Ed. 3. Reinforced Concrete: Mechanics and Design - James Wight and James MacGregor, 6th Ed. 4. Fundamentals of Reinforced Concrete – Ferguson & Philip 5. Bangladesh National Building Code (BNBC) 6. Design of Prestressed Concrete Structure – T.Y. Lin, Ned H. Burns, 3rd Ed. 7. Prestressed Concrete Structures - Michael P Collins			

6.1.4 Interdisciplinary Courses offered to CSE Dept

COURSE INFORMATION			
Course Code Course Title	: CE 150 : Engineering Drawing and CAD Sessional	Lecture contact hours Credit hours	: 3.00 : 1.5

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This course will be useful for designing and drawing schematics for simple blocks, orthographic and isometric representations, dimensioning, drawing of basic civil engineering components using AutoCAD which will be helpful during project work in later semesters, as well as professionally.

OBJECTIVE

- To impart knowledge of different terms, projections and views in field of engineering
- To make the students efficient in drawing and understanding civil drawing.
- To know about basics engineering drawing formats
- To gain knowledge about the basic functions of AutoCAD efficiently
- To take data and transform it into graphic drawing

COURSE CONTENT
Introduction, Lettering, numbering and heading, Instruments and their use, Sectional views and isometric views of solid geometrical figure, Plan, Elevation and Section of one-story building, Detailed drawing of lattice towers, Use of AutoCAD software.

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	Ability to **Understand** 2D and 3D views of simple objects.	√											
2	Ability to **Apply** the knowledge to draw sectional view, plan view and elevation of	√				√							

	various objects and structures by hand and AutoCAD.												

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** 2D and 3D views of simple objects.	1	C2	-	1	2	Class Test, Mid-term, Pop quiz, Final Exam
CO2	Ability to **Apply** the knowledge to draw sectional view, plan view and elevation of various objects and structures by hand and AutoCAD.	1,5	C3	-	1, 2	2,5	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 (3 hours/week x 12 weeks)	36
Guided Learning Report Writing (1 hour/week x 12 weeks)	12
Independent Learning Preparation for tests and examination	9
Assessment Quiz Viva	02 01
Total	60

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

TEACHING SCHEDULE

Week	Topics	Assessments
1	An overview on engineering drawing, Various instruments and their use, Scale & measurement, Concept of 3D view, Difference between perspective, oblique & isometric view, concept of isometric & orthographic view, home assignment	Quiz/Viva, Report/Assignment
2	Practice orthographic view and problem solving	
3	Class assessment, drawing orthographic from isometric and isometric from orthographic.	
4	Plan/Elevation of Building	
5	Section of Building	
6	CSE Drawing	
7	Quiz	
8	AutoCAD Tools	
9	AutoCAD Tools	
10	AutoCAD Tools + Isometric Views	
11	AutoCAD Orthographic + Sectional views	
12	AutoCAD Plan of Building	
13	AutoCAD Elevation + Section of Building	
14	Quiz	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Continuous Assessment Observation	40%	CO1	C2

Quiz	60%	CO 1	C3
Total Marks	100%		
REFERENCE BOOKS			

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