RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

INFORMATION BOOKLET FOR UNDERGRADUATE AND POSTGRADUATE STUDIES

First Edition (March 2009)

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DEPARTMENT OF CIVIL ENGINEERING

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PREFACE

It is of immense pleasure to introduce the first edition of the *Information Booklet for Undergraduate and Postgraduate Studies*. This booklet presents the course study and research program of the Department of Civil Engineering. A list of faculty members along with their research interest and research facilities available and detail outline of courses offered by the department are included in this booklet.

Civil Engineering, which applies technical skills of the creation and operation of Civil Engineering systems, is a broad-based discipline. The Civil Engineering Department at Rajshahi University of Engineering & Technology (RUET) offers both undergraduate (Bachelor of Science in Engineering) and postgraduate (Master of Science in Engineering, Master of Engineering and Ph.D.) program. The B.Sc.Engg. is a four-year program that prepares the students to enter professional practice of various Civil Engineering fields or to continue advanced study leading to M.Sc. Engg. / M.Engg and Ph.D. The M.Sc. Engg. / M. Engg. is a one and a half year (three semesters) full time program and the duration of Ph.D. course will be usually three years (six semesters).

The rules and regulations shown in this booklet may be changed or modified as and when necessary. This information booklet will help the concerned students as well as the Student Advisors of the Civil Engineering Department.

Rajshahi
March 2009

Professor Dr. Tarif Uddin Ahmed
Head
Department of Civil Engineering
Rajshahi University of Engineering & Technology

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Chapter - I

General Information

1.1 The University

Rajshahi University of Engineering & Technology is the second oldest University for the study of Engineering in Bangladesh. In order to create facilities for undergraduate and postgraduate studies and research, the Engineering College, Rajshahi established in 1964 was converted to BIT, Rajshahi in the year 1986 and the BIT, Rajshahi was upgraded to Ragshahi University of Engineering & Technology (RUET) in 2003. With a view to meet the increasing demand for engineers in the country and to expand the facilities for advancement of engineering education, Engineering college, Rajshahi was started functioning as a Faculty of Engineering under the University of Rajshahi offering four years Bachelor Degree in Civil, Electrical and Mechanical Engineering. Starting with 122 undergraduate students, the University has now about 1900 undergraduate and around 60 postgraduate students.

1.2 Location of the University

RUET campus spreading over 152 acres of land is located at about 3 kilometers east of Rajshahi city center by the side of the mighty river the Padma and adjacent to Rajshahi University. The Rajshahi city is well connected by road and rail with other towns of Bangladesh. The famous Rajshahi silk and mango are produced here. The average temperature of the city varies from 15°C to 40°C. Rickshaw, human hauler, taxi and bus facilities are available to reach the campus from any place of the city.

1.3 The Campus

RUET has a compact campus with departments, laboratories, workshops, library, auditorium, gymnasium, central common room, halls of residence (for male and female students) and residential buildings for teachers and employees within walking distances of the academic building. Bank and Post-office are also located in the same building. There is a school cum college in the campus in view of getting the proper education of the children of employees. A general store and a restaurant are also situated very near to the student halls. The varieties plant and tree gives pleasant and natural environment in the campus.

1.4 Facilities Offered by the University

1.4.1 Central Library

The central library building is located at the center of university campus. As an integral component of the academic program, the Central Library provides the following services to the teachers and students.

i) Issue and receipt of books
ii) Reading room facility
iii) Periodicals and Journal section.

1.4.2 Central Computer Center

The Central Computer Center provides computing support to undergraduate and postgraduate teaching and research application in all Departments. This center possesses networking facilities with Brand IBM PC's. This center also provides some useful softwares like C, C^{++}, Visual Fox Pro, Oracle, Auto CAD Unix/ Linux, MS-DOS, MS-WORD, Excel, Fortran etc.

1.4.3 Medical Center

A on campus medical center provides primary and basic health care facilities to the students (residential and non-residential) free of charges. Full-time MBBS doctors, compounder and staffs provide these facilities to the students. For specialized consultation on complicated cases, the center refers the patients to specialist consultants.

1.4.4 Directorate of Students Welfare

The Directorate of Student's Welfare is responsible for the various activities related to the physical, social, cultural and other aspects of welfare of the students. These include arrangement of supervision for halls of residence, programs for physical education, games and sports, cultural weeks and other activities of the students through the central students union and the students unions of the various halls of residence.

The central students union, whose members are elected by the students, oversees the socio-cultural activities of the students and looks after the problems of the students.

The students unions of the various halls of residence also arrange their individual socio-cultural activities, literary competitions etc. and help the hall authority to run the halls smoothly.

1.4.5 Sports and recreation facilities

The athletic club of the University provides multi-purpose sports facilities to the students to acquire physical fitness indispensable for a healthy mind and body. The University maintains a beautiful play ground for football, cricket, badminton, volleyball, tennis etc. A gymnasium within the University plays an important role to build up the health of the students. Indoor facilities are also available in the gymnasium building. The athletic club arranges gorgeous annual sports in every year. Parallel to the University, departments and students unions of the various halls of residence also arrange inter-class and inter-department football, cricket, basketball, and volleyball competitions in every year.

1.4.6 Residential accommodation

Campus life is an important aspect in the development process of students. In addition to provide services in assisting students in solving problems that affect their studies, the University aims to create an environment conducive to cultural development and promotion of interaction among staff, students and intellectuals.

The University has five halls of residence for the accommodations of the students. The total capacity of the halls is around 1500. Name of the halls with their capacities is listed below. Three halls are named after the national heroes who were the students of this University and sacrificed their lives in 1971 in the liberation war of Bangladesh. Another hall was named after the Late President of our country Shahid Ziaur Rahman.

Sl. No.	Halls of Residence	Capacity
1	Shahid Lt. Selim Hall	350
2	Shahid Shahidul Islam Hall	225
3	Shahid Abdul Hamid Hall	225
4	Tin Shed Hall	100
5	Ladies Hall	120
6	Shahid President Ziaur Rahman Hall	480

University provides accommodation facility for 75% of the students in these halls. Non-residential students are also required to attach with a hall, so that administrative control on students becomes hall-based. Depending on the size of the room, 2 to 4 students are accommodated in a room in these halls. Each hall has separate common room, reading room and other service facilities.

1.4.7 Facilities offered by the Civil Engineering Department

The Department of Civil Engineering has a number of facilities to meet up the requirements of both undergraduate and post-graduate studies. These facilities include rental library facility and computer laboratory facility. The Department has also the following laboratories and workshops available for research, instruction and sessional classes.

1. Strength of Materials laboratories
2. Reinforced Concrete laboratories
3. Soil Mechanics laboratories
4. Computer laboratories
5. Fluid Mechanics laboratories
6. Transportation laboratories
7. Environmental Engineering laboratories
8. Survey laboratories

All the above labs and workshops are well equipped under the Government and UNDP grants.

University Administration

Vice-Chancellor	Prof. Dr. Muhammad Fazlul Bari
Deans of Faculties	
Dean of Civil Engineering	Prof. Dr. Shaikh Md. Nizamud-Doulah
Dean of Electrical & Electronic Engineering	Prof. Dr. Md. Ruhul Amin
Dean of Mechanical Engineering	Prof. Dr. Mohd. Rafiqul Alam Beg
List of Administrative Officers	
Registrar (in charge)	Prof. Dr. Md. Faizur Rahman
Controller of Examinations	Engr. Md. Wazihar Rahman
Librarian (in charge)	Md. Azizul Islam
Director of Students' Welfare	
Director of Planning and Development	Prof. Dr. Tohur Ahmed
Director of Research and Extension	Prof. Dr. Mohd. Rafiqul Alam Beg
Comptroller (in charge)	Nazimuddin Ahmed

List of Faculty Members of the Department

Head of the Department

Professor Dr. Tarif Uddin Ahmed: B.Sc. Engg., Rajshahi University; M. Tech., IIT Kharagpur, India; Ph.D., IIT Kharagpur, India.

Professors

Dr. Tohur Ahmed: B.Sc. Engg., Rajshahi University; M.Sc. Engg., BUET; Ph.D., BUET.

Dr. Md. Shafi Uddin Miah: B.Sc. Engg., Rajshahi University; M. Engg., BUET; Ph.D., IIT Kharagpur, India.

Dr. Shaikh Md. Nizamud-Doulah: B.Sc. Engg., Rajshahi University; M.Tech., IIT Kharagpur, India; Ph.D., BUET.

Dr. Syed Abdul Mofiz: B.Sc. Engg., Rajshahi University; M.Sc. Engg., BUET; Ph.D., Malaysia.

Dr. Tarif Uddin Ahmed: B.Sc. Engg., Rajshahi University; M. Tech., IIT Kharagpur, India; Ph.D., IIT Kharagpur, India.

Iqbal Matin: B.Sc. Engg., Rajshahi University; M. Engg., BUET.

Associate Professors

Mohd. Abdus Sobhan: B.Sc. Engg., Rajshahi University; M.Sc. Engg., BUET.

Assistant Professors

Dipok Chandra Serker: B.Sc. Engg., BIT Rajshahi; M.Sc. Engg., AIT, Thailand; (Abroad on higher studies).

Md. Abdul Alim: B.Sc. Engg., BIT Rajshahi; M.Sc. Engg., Saitama University, Japan; (Abroad on higher studies).

N.H.M. Kamruzzaman Serker: B.Sc. Engg., BIT Rajshahi; M.Sc. Engg., AIT, Thailand; (Abroad on higher studies).

Dr. Md. Kumruzzaman (1): B.Sc. Engg., BIT Rajshahi; M.Sc. Engg., Saitama University, Japan; Ph.D., The Hongkong Polytechnic University, Hongkong.

M.M.Younus Ali: B.Sc. Engg., BIT Rajshahi; M.Sc. Engg., Saitama University, Japan.

Md. Kamruzzaman (2): B.Sc. Engg., BIT Rajshahi; M.Sc. Engg., Japan; (Abroad on higher studies).

Md. Niamul Bari: B.Sc. Engg., BIT Rajshahi; M.Sc. Engg., BUET; (Abroad on higher studies).

S.M. Zohurul Islam: B.Sc. Engg., BIT Rajshahi; M.Sc. Engg., University Putra, Malayasia; (Abroad on higher studies).

Md. Mahmud Sazzad: B.Sc. Engg., BIT Rajshahi; M.Sc. Engg., Saitama University, Japan; (Abroad on higher studies).

Md. Mizanur Rahman: B.Sc. Engg., BIT Rajshahi; (Abroad on higher studies).

Md. Akter Hossain: B.Sc. Engg., BIT Rajshahi; (Abroad on higher studies).

Md. Wasiul Bari: B.Sc. Engg., BIT Rajshahi; M.Sc. Engg., Saitama University, Japan; (Abroad on higher studies).

Md. Shafiqul Islam: B.Sc. Engg., BIT Rajshahi; M.Sc. Engg., Tokyo University, Japan; (Abroad on higher studies).

Md. Robiul Awall: B.Sc. Engg., BIT Rajshahi; M.Sc. Engg., Saitama University, Japan.

Lecturers

Md. Rajibul Karim: B.Sc. Engg., RUET; (Abroad on higher studies).

Md. Nurul Islam: B.Sc. Engg., RUET; (Abroad on higher studies).

Md. Abu Sayeed : B.Sc. Engg., RUET; (Abroad on higher studies).

Dalim Kumar Paul: B.Sc. Engg., RUET; (Abroad on higher studies).

Md. Ohiduzzaman: B.Sc. Engg., RUET.

Md. Abdul Lahil Baki: B.Sc. Engg., RUET; (Abroad on higher studies).

H.M. Rasel: B.Sc. Engg., RUET.

Md. Wahid Ferdous: B.Sc. Engg., RUET.

Kamrun Nahar: B.Sc. Engg., RUET.

Research Areas of the Teachers

Sl. No.	Teachers Name	Field of Interest
1.	Dr. Tohur Ahmed (tohurruet@yahoo.com)	Structural Engineering
2.	Dr. Md. Shafi Uddin Miah (shafi-ruet@yahoo.com)	Water Resources Engineering-Fluid Mechanics, Hydraulics and Hydraulic Machine, Open Channel Flow, Ground Water Hydraulics, Hydrology, Irrigation and Drainage Engineering, Hydraulic Structures.
3.	Dr. Shaikh Md. Nizamud-Doulah (sknizam1@yahoo.com)	Structural Engineering
4.	Dr. Syed Abdul Mofiz (samofiz@yahoo.com)	Geotechnical Engineering-Geoenvironmental Engineering, Constitutive Modelling in soil Mechanics, Stress Path and Advanced Triaxial Testing, Sub-soil Exploration and Field Testing, Landfill and Geosythetics Clay Lines, GIS in Geotechnical Engineering.
5.	Dr. Tarif Uddin Ahmed (tuahmedruet@yahoo.com)	Structural Engineering
6.	Iqbal Matin (imatinbd@yahoo.com)	Water Resources Engineering- Fluid Mechanics, Hydrology, Climatology, River Engineering; Engineering Drawing, Geology, Geomorphology, Surveying.
7.	Mohd Abdus Sobhan (msobhan@yahoo.com)	Transportation Engineering
8.	Dipok Chandra Serker (dipok47@yahoo.com)	Environmental Engineering
9.	Md. Abdul Alim (maalim@yahoo.com)	Geotechnical Engineering
10.	N.H.M. Kamruzzaman Serker (kserker@yahoo.com)	Structural Engineering
11.	Dr. Md. Kumruzzaman (1) (kzzaman2001@hotmail.com)	Geotechnical Engineering
12.	M.M.Younus Ali (mmyali13@yahoo.com)	Geotechnical Engineering-Time dependent deformation characteristics of soil.
13.	Md. Kamruzzaman (2) (kserker@yahoo.com)	Architectural Engineering
14.	Md. Niamul Bari (niamulbari@yahoo.com)	Environmental Engineering
15.	S.M. Zohurul Islam (smzislam190@yahoo.com)	Structural Engineering
16.	Md. Mahmud Sazzad (msazzad93@yahoo.com)	Geotechnical Engineering
17.	Md Mizanur Rahman (mmrahman@adfa.edu.au)	Geotechnical Engineering
18.	Md. Akter Hossain (akhtar412002@yahoo.com)	Geotechnical Engineering
19.	Md. Wasiul Bari (wasiul_bari@yahoo.com)	Geotechnical Engineering-Soil Mechanics & Stabilization Method.

20.	Md. Shafiqul Islam (islam94001@yahoo.com)	Structural Engineering- Concrete Technology.
21.	Md. Robiul Awall (robiul95@yahoo.com)	Structural Engineering- Structural Dynamics & Control, Wind Engineering, Cable Supported Structure (Cable-stayed bridge, Suspension bridge, Transmission line etc), Earthquake Engineering, FE Analysis.
22.	Md. Rajibul Karim (rajibul_karim@yahoo.com)	Geotechnical Engineering
23.	Md. Nurul Islam (nislam_ce@yahoo.com)	Geotechnical Engineering
24.	Md. Abu Sayeed (sayeed.ce00@yahoo.com)	Geotechnical Engineering- Geoenvironmental Science.
25.	Dalim Kumar Paul (dalim49@yahoo.com)	Geotechnical Engineering
26.	Md. Ohiduzzaman (ozamanruet@yahoo.com)	Transportation Engineering
27.	Md. Abdul Lahil Baki (engbakiruet@yahoo.com)	Geotechnical Engineering
28.	H.M. Rasel (hmrruet@yahoo.com)	Water Resources Engineering
29.	Md. Wahid Ferdous (wf_jewel@yahoo.com)	Structural Engineering
30.	Kamrun Nahar (knahar47@yahoo.com)	Geotechnical Engineering

Chapter - II

Academic Ordinance for Undergraduate Studies for the Award of Bachelor of Science in Engineering Degree

1. Definitions

1.1 'RUET' means Rajshahi University of Engineering & Technology.

1.2 'Syndicate' means the syndicate of the University.

1.3 'Academic Council' means the Academic Council of the University.

1.4 'Committee of Courses and Studies' means the Committee of Courses for Undergraduate Studies of a Degree Awarding Department of the University. But now all of these activities are done by the "Academic Committee" (U.G) which means the academic committee for undergraduate course of study.

2. Departments

2.1 Degree Awarding Departments

The University has the following Degree Awarding Departments:

i) Department of Civil Engineering
ii) Department of Computer Science & Engineering
iii) Department of Electrical & Electronic Engineering
iv) Department of Mechanical Engineering
v) Department of Electronics & Telecommunication Engineering
vi) Department of Industrial Production Engineering.
vii) Any other Department to be instituted by the syndicate on the recommendation of the Academic Council.

2.2 Teaching Departments

The University has the following Teaching Departments as defined in the statutes:

i) Department of Civil Engineering
ii) Department of Computer Science & Engineering
iii) Department of Electrical & Electronic Engineering
iv) Department of Mechanical Engineering
v) Department of Electronics & Telecommunication Engineering
vi) Department of Industrial Production Engineering
vii) Department of Mathematics
viii) Department of Chemistry
ix) Department of Physics
x) Department of Humanities
xi) Any other Department to be instituted by the Board on the recommendation or the Academic Council.

3. Degrees Offered

The University offers courses leading to the award of the following degrees:

i) Bachelor of Science in Civil Engineering abbreviated as B.Sc. Engg. (Civil).

ii) Bachelor of Science in Computer Science & Engineering abbreviated as B.Sc. Engg. (Computer Science & Engineering).

iii) Bachelor of Science in Electrical & Electronic Engineering abbreviated as B.Sc. Engg. (Electrical & Electronic Engineering).

iv) Bachelor of Science in Mechanical Engineering abbreviated as B.Sc. Engg. (Mechanical Engineering).

v) Bachelor of Science in Electronics & Telecommunication Engineering abbreviated as B.Sc. Engg. (Electronics & Telecommunication Engineering).

vi) Bachelor of Science in Industrial & Production Engineering abbreviated as B.Sc. Engg. (Industrial & production Engineering).

. vii) Any other degree that may be awarded by a department on the approval of the Board on the recommendation of the Academic council.

4. Student Admissions and Equivalence Committee

4.1 The four academic years of study for the degree of B.Sc. Engineering have been designated as 1st year class, 2nd year class, 3rd year class and 4th year class in succeeding higher levels of study. Students generally admit in the 1st year class. In special cases, students may be admitted into a higher year class on the recommendation of the appropriate Equivalence Committee and Department concerned.

4.2 The Academic Council forms an Admission Committee for admission in each academic session in 1st year B.Sc. Engineering class.

4.3 A candidate for admission in the 1st year class must have passed the H.S.C Examination from a Higher Secondary Education Board in Bangladesh (after 12 years of schooling) with Physics, Chemistry and Mathematics as his/ her subjects of Examination in Higher Secondary level or examination recognized as equivalent to and must also fulfill the requirements prescribed by the Admission Committee.

4.4 The rules and conditions for admission into various courses of studies or Departments shall be framed by the Academic Council on the recommendation of the Admission Committee.

4.5 All candidates for admission in the courses of B.Sc. Engineering must be citizens of Bangladesh unless the candidature is against the seats that are reserved for foreign students. Candidates for all seats except the reserved ones, if any, are selected on the basis of merit. The Academic Council on the recommendation of the Admission Committee frames the rules for admission in the reserved seats.

4.6 No student ordinarily be admitted in the 1st year class after the corresponding classes start or after the call goes out for admission into the next session, whichever is earlier.

4.7 Admission on of a newly admitted student in the 1st year class is cancelled if for first two consecutive weeks after the start of class he/ she remains absent without prior permission. Newly admitted students should be notified at least four weeks before commencement of the classes. If any student fails to report due to unavoidable circumstances within the stipulated first two weeks time, he/ she may appeal within the next four weeks to the academic council. The council's decision will be final.

4.8 An Equivalence Committee consisting of at least five members is formed by the Academic Council to consider the equivalence of different public examinations.

4.9 Every student being admitted to the University shall be examined by a competent medical officer as may be provided in the admission rules.

5. Method of Course Offering and Instruction

The undergraduate curricula at RUET, Rajshahi are based on course system. The salient features of course system are:

i) Number of theoretical courses and examination papers will not exceed five in each semester.

ii) The absence of pass or fail on an semester basis.

iii) Continuous evaluation of student's performance.

iv) Evaluation by using Letter Grades and Grade Points instead of Numerical Grades.

v) Introduction of some additional optional courses and thus enable students to select courses according to his/ her interest as far as possible.

vi) Opportunity for students to choose fewer or more courses than the normal course load depending on his/ her ability and needs.

vii) The flexibility to allow a student to progress at his/ her own pace depending on his/ her ability or convenience, subject to the regulations on credit and minimum grade point average (GPA) requirements, and

viii) Promotion of teacher-student contact.

In the curriculum for the undergraduate programs, besides the professional courses pertaining to each discipline, there is a strong emphasis on acquiring a thorough knowledge in basic sciences of mathematics, physics and chemistry and subjects in humanities and social sciences. Emphasis has been given to introduce courses dealing with professional practices, project planning and management, socio-economic and environmental aspects of development projects, communication skills etc. This will help the students to interact more positively with the society.

6. Academic Calendar

6.1 The academic year is ordinarily divided into two semesters each having a duration of ordinarily not less than 13 teaching weeks.

6.2 There are final examinations at the end of each semester conducted by the respective degree awarding departments of the University.

6.3 On the approval of the Academic Council an academic schedule for the year is announced for general notification before the start of the academic year.

The schedule may be prepared according to the following guidelines:

Semester-I	**Weeks**
Classes	13
Mid-semester recess	1
Duration of Semester Final Examination including recess	4.1*
Publication of result	1.6*
Total for Semester-I	20
Inter-semester Recess and Preparation for next semester	1
Semester-II	**Weeks**
Classes	13
Mid-semester recess	1
Duration of Semester Final Examination including recess	4.1*
Publication of result	1.6*
Total for Semester-II	20
Inter session break, Ramjan and other Vacations throughout the session	11
Total =	**52**

* The digit after the decimal indicates number of days.

7. Duration of Course and Course Structure

7.1 The B.Sc. Engineering courses extend over a period of four academic years (8 semester), each of a normal duration of one calendar year, which is divided as necessary for the purpose of academic program and conduct of examinations.

7.2 The curricula of the B.Sc. Engineering degree in the different departments is as proposed by the Committee of Courses and Studies and approved by the syndicate on the recommendation of the Academic Council.

7.3 The Committee of Courses and Studies review the curricula at least once every academic year and put forward suggestions to the Academic Council.

7.4 Teaching for the courses is reckoned in credits and the credits allotted to various courses are determined by the Committee of Courses and Studies with the following guidelines:

Nature of Course	**Contact hour**	**No. of Credit**
i) Theory Lecture	1 hour/ week	1
ii) Tutorial	1 hour/ week	1
iii) Independent Lab/ sessional/ design	3/2 hour/ week 2 hour/ week 3 hour/ week	0.75 1 1.5
iv) Project/ thesis	6 hour/ week	4.5
v) Field work	2 weeks of field work	1

7.5 The total number of credits that a student has to complete successfully for the award of B.Sc. Engineering degree is between 150-162. The maximum period of candidature is seven years, i.e., 3 years (6 semesters) more than the normal time required to complete the course.

The total number of credits for which a student should register shall be between 15 to 22 credits per week in a semester. However, a student may be allowed to register for less than 15 credits in a semester if-

i) he is considered academically weak.

ii) number of credits required for graduation is less than 15 in that semester and

iii) student can not find appropriate courses for registration subject to the approval of the adviser.

7.6 The total contact hours for students including lecture, tutorial and lab/ sessional is around 25 periods per week, each period being of 50 to 55 minutes duration with a break of 5 minutes.

7.7 There should be an empty slot in the class routine to accommodate back logged courses if necessary.

7.8 In each degree-awarding department, one of the senior teachers nominated by the Head of the Department acts as Course Coordinator who acts as Member Secretary to the committee of Courses and Studies.

7.9 A course plan for each course, approved by the Course Coordinator, showing details of lectures may be announced at the start of each semester.

7.10 Project & thesis should preferably be of 3 credits. Credit in any theory subject dose not exceeds 4 and in sessional subject dose not exceeds 1.5.

8. Course Designation and Numbering System

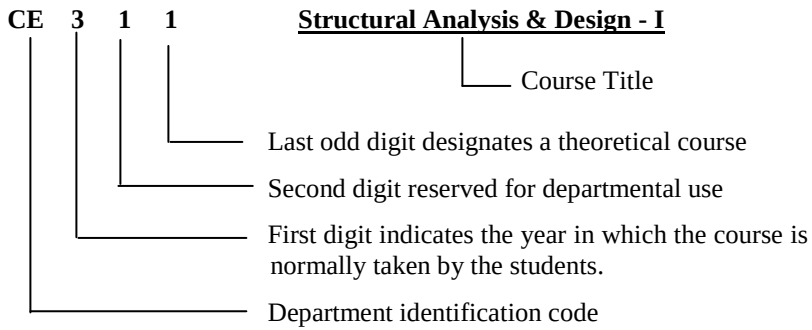
Each course is designated by a two to four letter word identifying the department which offers it following by a three digit number with the following criteria:

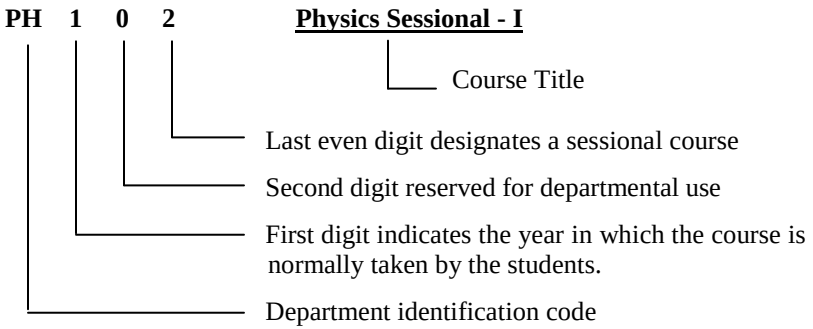
a) The first digit corresponds to the year in which the course is normally taken by the students.

b) The second digit reserved for departmental use indicating major area.

c) The 3rd digit is usually odd for theoretical and even for laboratory or sessional courses.

The course designation system is illustrated by one example as shown below:





9. Types of Courses

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

9.1 **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 all of the designated core courses for his discipline.

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

9.3 **Optional Courses:** Apart from the core courses, students have to complete a number of courses which are optional in nature. In that, students have some choice to choose the required number of courses from a specified group/ number of courses.

10. Departmental Monitoring Committee and Student Adviser

10.1 Each department constitutes a Departmental Monitoring Committee with two teachers of the Department as members nominated by the Committee of Courses and Studies and Head of the Department as chairman. This committee monitors and evaluates the performance of the Course System within the Department. The committee may also propose from time to time to the Committee of Courses and Studies any changes and modifications needed for upgrading/ changing the undergraduate curriculum and the course system.

10.2 **Student Adviser:** One adviser is appointed for a batch of student by the Department Monitoring Committee of the concerned Department(s) who advises each student on the courses to be taken by a student. Adviser discusses with the student his academic program and then decides the number and nature of courses for which he can register. However, it is the student's responsibility to keep contact with his adviser who reviews and eventually approves the student's specific plan of study and checks on subsequent progress. The adviser generally be of the rank of an Assistant Professor or above from the concerned Department(s). However, in case of shortage of teachers, senior Lectures may also act as adviser.

For a student of second and subsequent semesters, the number and nature of courses for which he can register is decided on the basis of his academic performance during the previous semester. The adviser advises the students to register for the courses during the next semester within the framework of the guidelines in respect of minimum/ maximum credit hours limits.

He is also authorized to permit the student to drop one or more courses based on his academic performance. Special provisions exist for academically weak students with regard to make-up courses.

11. Registration Requirements

Any student who wants to study a course is required to register formally. Being admitted to the University, each student is assigned to a student adviser. The student can register for courses he/ she intends to take during a given semester only on the basis of the advice and consent of his/ her adviser.

11.1 **Registration procedure:** Students must register for each class in which they will participate. Each student will fill up his/ her Course Registration Form in consultation with and under the guidance of his/ her adviser. The original copy of the Course Registration Form will be submitted to the Registrar's Office, and then the requisite number of photo copies will be made by the Registrar's office for distribution to the adviser and Head. The date, time and venue for registration will be announced in advance by the Registrar's Office. It is absolutely necessary that all students present themselves for registration at the specified time.

11.2 **Limits on the credit hours to be taken:** A student must be enrolled for the requisite number of credits as mentioned in article 7.5. A student must enroll for the prescribed sessional/ laboratory courses in the respective semester within the allowed credit limits.

11.3 **Pre-condition for registration:** A student will be allowed to register in those courses subject to the capacity constrains and satisfaction of pre-requisite courses. If a student fails in a pre-requisite course in any semester, the concerned Department Monitoring Committee may allow him to register for a course which builds on the pre-requisite course provided his attendance and grades in continuous assessment in the said pre-requisite course is found to be satisfactory.

Registration will be done at the beginning of each semester. Late registration is however, permitted during the first week on payment of a late registration fee. Students having outstanding dues to the University or a hall of residence shall not be permitted to register. All students have therefore, to clear their dues and get a clearance or no dues certificate, on the production of which, they will be given necessary Course Registration Forms and complete the course registration procedure. Registration Forms are normally available in the Register's office. An orientation program will be conducted for only the first year students at the beginning of the first semester when they will be handed over the registration package on producing enrollment slip/ proof of admission.

11.4 **Pre-registration:** Pre-registration for courses to be offered by the students in a particular semester will be done on a specified date before the end of the previous semester. All students in consultation with their course adviser are required to complete the pre-registration formalities, failing which a fine may be decided by the authority will have to be paid before registration in the next term. Further a student who does not pre-register may not get the courses desired by him subsequently.

11.5 **Registration deadline:** Student must register for the courses to be taken before the commencement of each semester and no late registration will be accepted after one week of classes which may be relaxed up to a maximum of two weeks for the newly admitted first year students. Late registration after this date will not be accepted unless the student submits a written appeal to the Registrar through the concerned Head and can document extenuating circumstances such as medical problems (physically incapacitated and not able to be presented) or some other academic commitments which precluded enrolling prior to the last date of registration.

11.6 **Penalty for late registration:** Students who fail to register during the designated dates for registration are charged a late registration fee decided by the authority. This extra fee will not be waived whatever be the reason for late registration.

11.7 **Course adjustment procedure:** A student would have some limited options to add or delete courses from his/ her registration list, within the first two weeks from the beginning of the semester. Adjustment of initially registered courses in any semester can be done by duly completing the Course Adjustment Form. These forms are normally available in the Registrar's Office. For first year students such forms can be included in the registration packet at the time of orientation.

Any student willing to add or drop courses will have to fill up a Course Adjustment Form in consultation with and under the guidance of his/ her adviser. The original copy of the Course Adjustment Form will be submitted to the Registrar's Office and then the requisite number of photo copies will be made by the Registrar's Office for distribution to the concerned Adviser, Head and the student. All changes in courses must be approved by the Adviser and the Head of the department concerned. The Course Adjustment Form will have to be submitted to the Registrar's Office after duly filled in and signed by the concerned persons. To add/ drop a course respective teacher's consent will be required.

11.8 **Withdrawal from a semester:** If a student is unable to complete the semester final examination due to illness, accident or any other valid reason etc., he/ she may apply to the Head of the degree awarding department for total withdrawal from the semester within a week after the end of the semester final examination. However, he/ she may choose not to withdraw any laboratory/ sessional/ design course if the grade obtained in such a course is 'D' or better. The application must be supported by a medical certificate from any authorized Medical Officer. The Academic Council will take the final decision about such applications.

12. Striking off the Names and Readmission

12.1 The names of the students shall be struck off and removed from the rolls on the following grounds:

i) Non-payment of University fees and dues within the prescribed period.

ii) Forced to discontinue his/ her studies under disciplinary rules.

iii) Withdrawal of names from the rolls of the University on grounds acceptable to the Vice-Chancellor of the University after having cleared all dues.

iv) Could not earn required credits for graduation as outlined in the respective curriculum and/ or fulfill CGPA requirement within the maximum allowed time of 7 academic years.

12.2 Every student whose name has been struck off the rolls by exercise of the clause (ii) of Article 12.1 seeking readmission after expiry of the period for which he/ she was forced to discontinue his/ her studies, shall submit an application to the Head of the Department in the prescribed form before the commencement of the session to which he/ she seeks readmission. The Head of the Department shall forward the application to the Vice-Chancellor of the University with his remarks. In case the readmission is allowed the student will be required on payment of all dues to get him/ her-self admitted not later than one week from the date of permission given by the Vice-Chancellor. All readmission should preferably be completed before the session starts. The percentage of attendance of the readmitted students shall be counted from the date of readmission.

12.3 No student who has withdrawn his/ her name under clause (iii) of Article 12.1 shall be given readmission.

12.4 In case a student whose name has been struck off the rolls under clause (i) of Article 12.1 seeks readmission within the session in which his/ her name was struck off, he/ she shall be readmitted on payment of all the arrear fees and dues. But if he/ she seeds readmission in any subsequent session, the procedure for his/ her readmission will be the same as described under Article 12.2

The application of a student for readmission will only be considered if he/ she applies within two academic sessions from the semester of discontinuance of his/ her studies in the University. Other than debarment as punishment under ordinance of the University relating to discipline, a student of any kind failing for any other reason whatsoever to become a candidate for a semester final examination in which he/ she ought to have had in the usual process of his/ her progressive academic activities, shall be considered to have discontinued his/ her studies for the relevant semester together with striking the name off from current roll and two such discontinuance periods will be considered equivalent to that for one academic session. The maximum period of discontinuance under no circumstances is to exceed two academic sessions during a student's period of studies for the degree.

12.6 In case any application for readmission is rejected, the student may appeal to the Academic Council for re-consideration. The decision of the Academic Council shall be final.

12.7 A student, whose name has been struck off the rolls by exercise of clause (iv) of Article 12.1, is not eligible to seek readmission.

13. Grading System

The letter grade system shall be used to assess the performance of the student and shall be as follows:

Numerical grade	Letter grade	Grade point
80% or above	A^+ (A Plus)	4.0
75% to less than 80%	A (A Regular)	3.75
70% to less than 75%	A^- (A Minus)	3.5
65% to less than 70%	B^+ (B Plus)	3.25
60% to less than 65%	B (B Regular)	3.0
55% to less than 60%	B^- (B Minus)	2.75
50% to less than 55%	C^+ (C Plus)	2.5
45% to less than 50%	C (C Regular)	2.25
40% to less than 45%	D	2.0
Less than 40%	F	0

A grade 'X' shall be awarded for courses (like project & thesis, design etc.) in the odd semester, which continue through to the even semester.

13.1 **Calculation of GPA and $CGPA$:** Grade point average (GPA) is the weighted average of the grade points obtained in all the courses passed/completed by a student in a semester. 'F' grades will not be counted for GPA calculation. GPA of a semester will be calculated as follows:

$$GPA = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i}$$

where, n is the total number of courses passed by the student, C_i is the number of credits allotted to a particular course i and G_i is the grade point corresponding to the grade awarded for i-th course.

The overall or Cumulative Grade Point Average ($CGPA$) gives the cumulative performance of the student from first semester up to any other semester to which it refers and is computed by dividing the total grade points ($\Sigma C_i G_i$) accumulated up to the date by the total credit hours (ΣC_i). Both GPA and $CGPA$ are rounded off to the second place of decimal for reporting.

14. Distribution of Marks

14.1 **The distribution of marks for a given course is as follows**

i) **Theory courses**

Class participation and attendance	10%
Quizzes/ Class tests	20%
Semester Final Examination (3 hours duration)	70%
Total	**100%**

ii) **Independent laboratory/ sessional/ design/ field work courses**

Class participation and attendance	10%
Quizzes/ viva voce	15%
Viva voce (Conducted by Dept.)	25%
Performance/ reports	50%
Total	**100%**

iii) **Project and thesis**

Viva voce (conducted by a viva voce committee)	30%
Supervisor (internal examiner)	50%
External examiner (any other teacher of the department/ Examination committee)	20%
Total	**100%**

14.2 It is desirable that weightage on continuous assessment as described in Article 14.1 such as quizzes and class tests, class participation and attendance etc. should be increased up to 50% and weightage on semester final examination should be reduced to about 50% gradually.

14.3 Basis for awarding marks for class participation and attendance will be as follows:

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

14.4 The students whose percentage of attendance will fall short of 75% in any of the theory, lab/ sessional courses for which he/ she has registered in one academic year shall not be eligible for the award of any type of scholarship/ stipend/ grant for the following academic session.

15. Class Tests/ Quizzes

i) For 2 credit courses 3 best out of 4, for 3 credit courses 4 best out of 5 and 4 credit courses 5 best out of 6 quizzes/ class tests may be taken for awarding grade. These may be considered as the minimum recommended number of quizzes/ class tests for any course. If the number of quizzes/ class tests administered in a course exceeds these suggested minimum numbers, then two-thirds best of all may be considered.

ii) Duration of quizzes/ class tests should not exceed 15 minutes and materials covered should be what were taught in 2 to 3 previous classes or most recent classes.

iii) For convenience of conducting the class tests/ quizzes a half an hour time slot should be kept at the beginning of each working day.

iv) The dates for the quizzes/ class tests shall be fixed by the Head or Course Coordinator and dates shall be announced accordingly.

v) All class tests shall ordinarily be of equal value. The result of each individual class test shall be posted for information of the students preferably before the next class test is held.

16. Earned Credits

The courses in which a student has obtained 'D' or a higher Grade will be counted as credits earned by him/ her. Any course in which a student has obtained 'F' grade will not be counted towards his/ her earned credits.

A student, who obtains a 'F' grade in any Core Course in any semester, he/ she will have to repeat the course. If a student obtains a 'F' in an Optional Course, he/ she may choose to repeat the course or take a substitute course if available.

'F' grades will not be counted for GPA calculation but will stay permanently on the Grade Sheet and Transcript.

A student obtaining D grade in a course will be allowed to repeat the course for the purpose of grade improvement if CGPA of the student falls below 2.20. In such case he/ she will be awarded the new grade thus he/ she obtains or retains his/ her previous grade if he/ she fails.

17. Performance Evaluation

The minimum CGPA requirement for obtaining a B.Sc. Engineering degree is 2.20. The performance of a student will be evaluated in terms of two indices, viz. Semester grade point average and cumulative grade point average.

Students will be considered to be making normal progress toward a degree if their CGPA for all courses attended is 2.20 or more. Students who regularly maintain semester GPA of 2.20 or better are making good progress toward their degrees and are in good standing with the University. Students who fail to maintain this minimum rate of progress will not be in good standing. This can happen when one or more of the following conditions exist:

i) Semester GPA falls below 2.20 or

ii) Cumulative GPA falls below 2.20

iii) Earned credits fall below 15 times the number of semester attended/ studied.

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

Students whose GPA will fall below 2.20 will have to be notified so that the necessary remedial measures can be taken.

18. Gold Medal

Candidates for Bachelor's degree in engineering will be awarded the degree with honors if their CGPA is 3.75 or better.

If a student can show extraordinary brilliance and obtains all A or better grades in all the courses he/ she attended and fulfills the credit requirement for graduation will be honored by awarding President gold medal in a special function/ convocation.

19. Student Classification

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

Year	Earned Credits
First Year	0 to 35
Second Year	36 to 70
Third Year	71 to 105
Fourth Year	106 and above

20. Registration for the Second & Subsequent Semesters

A student is normally required to earn at least 15 credits in semester. At the end of each semester, the students will be categorized as follows:

Category-1

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

Category-2

Consisting of students who have earned at least 15 credits in the semester but do not belong to category 1. A student belonging to Category 2 is advised of take at least one course less in the next semester subject to the condition that he/ she has to register for such backlog courses as may be prescribed by the adviser.

Category-3

Consisting of students who have failed to earn 15 credits in the semester. A student belonging to Category 3 is advised to take at least two courses less subject for registration for minimum of 15 credits. However, he/ she will be required to register for such backlog courses as may be prescribed by the adviser.

21. Probation and Suspension

Undergraduate students who regularly maintain semester GPA of 2.20 or better satisfying the minimum credit requirements are making good progress toward their degrees and are in good standing with the University. Students who fail to maintain this minimum rate of progress may be placed on academic probation.

The status of academic probation is a reminder/ warning to the student that satisfactory progress towards graduation is not being made. A student may be placed on academic probation when either of the following conditions exists:

i) The semester GPA falls below 2.20 or

ii) The cumulative GPA falls below 2.20

Students on probation are subject to such restrictions with respect to courses and extracurricular activities as may be imposed by the respective Head of the Department.

The minimum period of probation is one semester, but the usual period is for one academic year. This allows the student an opportunity to improve the GPA through the completion of additional course work during the period that the student is on probation. The probation is extended for additional semesters until the student achieves an overall GPA of 2.20 or better. When that condition is achieved, the student is returned to good standing.

Academic probation is not being taken lightly- it is very serious matter. A student on academic probation who fails to maintain a GPA of at least 2.20 during two consecutive academic years may be suspended from this University. A student who has been suspended may apply for consideration to the Vice-Chancellor, but this application will not be considered until the student has been suspended at least one full semester.

Petitions for reinstatement must set forth clearly the reasons for the previous unsatisfactory academic record and it must delineate the new conditions that have been created to prevent the recurrence of such work. Each such petition is considered individually on its own merits. After consideration of the petition and perhaps after consultation with the student, adviser and the respective Head of the Department, Vice-Chancellor in some cases; reinstate the student if this is the first suspension. However, a second suspension will be regarded as final and absolute.

22. Measures for Helping Academically Weak Students

The following provisions are made as far as possible to help academically weak students to enable them to complete their studies within the maximum period of seven years.

a) All such students whose cumulative grade point average (CGPA) is less than 2.20 at the end of a semester may be given a load of not exceeding four theory/ combined courses in the next semester.
b) For other academic deficiencies, some basic and core courses may be offered during the regular semester under special arrangement in order to enable the student to partially make-up for the reduced load during regular semesters.

Following criteria are followed for determining academically weak students:

a) CGPA falling below 2.20

b) Semester grade point average (SGPA) falling below 2.20 points below that of previous semester.

c) Earned credit calling below 15 times the number of semester attended.

23. Minimum Earned Credit and GPA Requirements for Obtaining Degree

Minimum credit requirements for the awarded of Bachelor of Engineering Degree will be decided by the respective Committee of Courses and Studies. The minimum CGPA requirements for obtaining a Bachelor of Engineering Degree are 2.20.

A student may take additional courses with the consent of his/ her adviser in order to raise CGPA, but he/ she may take a maximum of 15 such additional credits beyond respective credit requirements for bachelor's degree during his/ her entire period of study.

24. Time Limits for Completion of Bachelor's Degree

A student must complete his/ her studies within a maximum period of 7 (seven) years for engineering.

25. Industrial/ Professional Training Requirements

Depending on each Department's own requirement a student may have to complete a prescribed number of days of industrial/ professional training in addition of minimum credit and other requirements, to the satisfaction of the concerned Department.

26. Application for Graduation and Award of Degree

A student who has fulfilled all the academic requirements for bachelor's degree will have to apply to the Register/ Vice-Chancellor through his/ her adviser for graduation. Provisional degree will be awarded on completion of credit and GPA requirements. Such provisional degrees will be confirmed by the academic council.

27. Inclusion of Repeaters from the Present System to the New Course System

Repeater students will be included in the course system of curricula as and when such situation will arise.

27.1 **Equivalence of Courses and Grades:** Equivalence of courses passed previously by any repeater student shall be determined by the respective Committee of Courses & Studies for the purpose of:

a) allowing course exemption and

b) conversion of present grades into proposed grades in exempted courses.

27.2 **Time Limit for Completion of Bachelor's Degree:** Time allowed for a student included in Course System from Previous System to complete studies leading to a bachelor's degree will be proportional to the remaining credits to be completed by him/ her.

A student in engineering for example, having earned 40 credit hours through equivalence and exemption (of previously completed courses) out of a total requirement of 162 credits for Bachelor's Degree will get
(7 yr. × 122/162 = 5.25) 5-1/2 years (rounded to next higher half-a-year) or 11 (eleven) regular semester to fulfill all requirements for bachelor's degree.

27.3 **Relaxation of Course Registration for Repeaters:** Relaxation of course Registration for a student transferred to course system from Previous system: The requirement of registrations of minimum 15 credit hours in a semester shall waived for only the semesters of the year where he/ she has been transferred in course system provided that he/ she has been granted exemption in some of the courses offered in those terms.

28. Absence During Semester

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

A student who has been absent for short periods, up to a maximum of three weeks due to illness, should approach the course teacher (s) or the course coordinator(s) for a make-up quizzes or assignments immediately on returning to the classes. Such request should be supported by medical certificate from University medical officer. The medical certificate issued by a registered medical practitioner (with the registration number shown explicitly or the certificates) will also be acceptable only in those cases where the student has valid reason for his/ her absence from the University.

29. Back Log Courses

Students are expected to clear any back log course during the Short Semester, which will usually be offered after two regular Semesters within an academic year. Experience shows that often an academic year cannot be completed in 12 months. In such cases it may neither be feasible nor beneficial to offer a Short Semester, because this will inevitably delay the commencement of the next regular Semester. In case a Short Semester cannot be arranged for one reason or the other, provision can be made in the class routine for a 6^{th} slot to enable students to take one back log course in addition to their regular semester load subject to the approval of his/ her adviser and Departmental Committee of Courses and Studies.

Chapter - III

Course Structure of the Four Year B.Sc. Engineering Program

Syllabus of Courses Offered in 1st Year B.Sc. Engineering

SEMESTER - I

SL No.	Course No.	Course Title	Contact Hour/ Week	Credit
1.	CE 101	Surveying	4	4
2.	CH 101	Chemistry-I	3	3
3.	PH 101	Physics-I	3	3
4.	Math 101	Mathematics-I	3	3
5.	Hum 101	English	2	2
6.	CE 100	Civil Engineering Drawing-I	3	1.5
7.	MES 102	Mechanical Engineering Shops	3	1.5
8.	CH 102	Chemistry Sessional -I	1.5	0.75
9.	PH 102	Physics Sessional-I	1.5	0.75
Total			**24**	**19.5**

No. of Theory Courses = 05
No. of Sessional Courses = 04

Total Contact Hour =24
Total Credit = 19.5

SEMESTER – II

SL No.	Course No.	Course Title	Contact Hour/ Week	Credit
1.	CE-103	Engineering Mechanics	4	4
2.	EEE 103	Basic Electrical Engineering	3	3
3.	CH 103	Chemistry-II	3	3
4.	PH-103	Physics-II	3	3
5.	Math-103	Mathematics-II	3	3
6.	CE-102	Practical Surveying	3	1.5
7.	CE-110	Civil Engineering Drawing-II	3	1.5
8.	CH 104	Chemistry Sessional-II	1.5	0.75
9.	PH-104	Physics Sessional -II	1.5	0.75
Total			**25**	**20.5**

No. of Theory Courses = 05
No. of Sessional Courses = 04

Total Contact Hour =25
Total Credit = 20.5

SEMESTER - I

CE 101 Surveying
Lecture: 4 hrs/ week **Credit: 4.00**

Introduction: linear measurements, chain survey, traverse survey and plane table survey. Leveling and Contouring: Calculation of areas and volumes, Problems on heights and distances, Curves and curve ranging. Tacheometry: introduction, principles and problems on tacheometry. Astronomical surveying: Definition, instruments, astronomical corrections and systems of time. Photogrametry: Introduction to terrestrial photography, aerial photography, reading of photo mosaic and scale. Project surveying: errors in surveying, remote sensing and introduction to global positioning system (GPS).

CH 101 Chemistry-I
Lecture: 3 hrs/ week **Credit: 3.00**

Atomic structure, periodic table, chemical bonds. chemistry of cement, silicates and limes. physical and chemical properties of water. Different types of solutions, concentration units, chemical equilibrium. Reactions kinetics: rate of chemical reactions, order and molecularity of reactions, different types of rate expressions, methods of determining rate and order, effect of temperature on reaction rate and energy of activation. Colloid and colloidal solution: classification, preparation, purification, properties, protective action and application of colloids.

CH 102 Chemistry-I Sessional
Contact hours: 1.5 hrs/ week **Credit: 0.75**

Volumetric analysis: acid-base titration, oxidation-reduction titration salts analysis (qualitative).

PH 101 Physics-I
Lecture: 3 hrs/ week **Credit: 3.00**

Physical optics: Theories of light: Huygen's principle and construction. Interference of light: Young's double slit experiment, Fresnel bi-prism, Newton's rings, interferometers. Diffraction of light: Fresnel and Fraunhoffer diffraction, diffraction by single slit, diffraction by double slit, diffraction gratings. Polarization of light: production and analysis of polarized light, optical activity, optics of crystals.

Heat and Thermodynamics: temperature, zeroth law of thermodynamics. Thermometers, constant volume, platinum resistance and thermocouple. First law of thermodynamics and its application, molar specific heats of gases, isothermal and adiabatic relations, work done by a gas. Kinetic theory of gases: explanation of gas laws, kinetic interpretation of temperature, equipartition of energy and calculation of ratio of specific heats, mean free path, Vander Waals equation of state, second law of thermodynamics: reversible and irreversible processes, Carnot's cycle, efficiency, Carnot's theorem, entropy.

Waves and Oscillations: Oscillations: Simple harmonic motion, damped simple harmonic oscillations, forced oscillations, resonance, vibrations of membranes and columns. Combination and composition of simple harmonic motions, Lissajous' figures. Transverse and longitudinal nature of waves, travelling and standing waves, intensity of waves, energy calculation of progressive and stationary waves, phase velocity, group velocity. Sound waves: velocity of longitudinal wave in a gaseous medium and Doppler effect. Architectural acoustics: Sabine's formula, requirements of a good auditorium.

PH 102 Physics Sessional -I
Contact Hours: 1.5 hrs/ week **Credit: 0.75**

Determination of the specific heat of a liquid by the method of cooling. Determination of the thermal conductivity of a bad conductor by Lee's method. Determination of the pressure coefficient of air by constant volume air thermometer. Determination of the frequency of a tuning fork by Melde's apparatus. Determination of the mechanical equivalent of heat by electrical method. Determination of the focal length of concave lens by auxiliary lens method. Determination of the refractive index of the material of a prism using spectrometer. Determination of the spring constant and the effective mass of a loaded spring.

Math 101 Mathematics-I
Lecture: 3 hrs/ week **Credit: 3.00**

Differential Calculus: Limit continuity and differentiability, *n*-th derivatives of standard functions. Leibnit'z theorem, Rolle's theorem and Mean value theorem. Expansion in finite and infinite forms, indeterminate form and partial differentiation. Euler's theorem. tangent and normal. Subtangent and subnormal in partial and polar co-ordinates. Maxima and minima of functions of single variables. Curvature.

Integral Calculus: Integration by parts. Standard integral. Integration by the method of successive reduction. Definite integrals. Improper integrals. Beta function. Gama functions. Multiple integrals. Area, Volume of solids of revolution.

Hum 101 English
Lecture: 2 hrs/ week **Credit: 2.00**

English phonetics: the places and manners of articulation of the English sounds. Vocabulary. English grammar: Construction of sentences, some grammatical problems. Comprehension. Composition on current affairs. Amplification, precis writing, Phrases and idioms. Commercial correspondence and tenders. Technical report writing, Lessons in spoken English, Drafting notes. Short stories written by some well-known classic writers.

CE 100 Civil Engineering Drawing-I
Sessional: 3 hrs/ week **Credit: 1.50**

Introduction, lettering, numbering and heading, Plane geometry, Pentagon, Hexagon, Octagon, Ellipse, Parabola, Hyperbola. Projection (Solid Geometry): cube, triangular prism, square prism, pentagonal prism, hexagonal prism, cone and cylinder. Development: cube, pyramid, cone and prism. Section and true shape: cube, pyramid, cone prism. Isometric drawing: cube, pyramid and cone. Oblique drawing: cube, pyramid and cone. Interpretation of solids: Plan, elevation and section of one-storied buildings.

MES 102 Mechanical Engineering Shops
Sessional: 3 hrs/ week **Credit: 1.50**

Carpentry shop (3/2 hrs/ week):
Wood working tools: wood working machine: Band saw, scroll saw, circular saw, jointer, thickness planer, disc sander, wood lathe, Types of sawing, common cuts in wood works, types of joint, Defects of timber, 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, and 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 machinery, welding of different types of material, 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.

SEMESTER - II

CE 102 Practical Surveying
Sessional: 3 Weeks in field **Credit: 1.50**

Practice on handling of instruments, chain survey, plane table survey, Theodolite traversing, Leveling and contouring, route project, house setting, curve setting, stadia surveying, height and distance problem.

CE 103 Engineering Mechanics
Lecture: 4 hrs/ week **Credit: 4.00**

Introduction to SI Units, coplanar concurrent forces, moments and parallel coplanar forces, non-concurrent non-parallel coplanar forces, centroids, moment of inertia of areas, moment of inertia of masses, Friction, flexible cords, plane motion, force systems that produce rectilinear motion, work, kinetic energy, power, impulse and momentum.

CE 110 Civil Engineering Drawing-II
Sessional: 3 hrs/ week **Credit: 1.50**

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

EEE 103 Basic Electrical Engineering
Lecture: 3 hrs/ week **Credit: 3.00**

Electrical units and standards. Electrical networks, series, parallel and series-parallel networks. Method of network analysis. Measurement of electrical quantities, resistance, current, voltage, power and energy measurements.

Alternating current: Instantaneous, rms and average values of current and voltage. Real and reactive power. Steady AC circuit analysis, single phase RLC circuit with sinusoidal excitation. Polyphase circuit, Balanced three phase circuit, Familiarization with different types of electrical machines, DC generators and motors, AC generators and motors and transformers.

Introduction to electronic principles and its simple applications.
Introduction to electrical wiring.

CH 103 Chemistry-II
Lecture: 3 hrs/ week **Credit: 3.0**

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

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

Polymers: chemistry of polymerization, different types of polymers and their properties, polymer-degradation, elastomers and composite materials.
Paints and varnishes: introduction to paints and varnishes, pre-treatment of the surface, metallic, non-metallic and organic protective coating, types of paints and their uses.

Principle of spectophotometric analysis: Beer Lambert law and its applications.

Thermo chemistry: Laws of thermo chemistry and problems based on them, Kirchoff's equation, Heat of solution and heat of neutralization.

CH 104 Chemistry Sessional-II
Lecture: 1.5 hrs/ week **Credit: 0.75**

Gravimetric analysis: determination of Fe, Cu, Ca, Cl, SO_4 Volumetrically spectophotometric estimation of As, Cr, Mn, Ca, Fe, Ni, Zn. Determination of pH of a solution.

PH 103 Physics-II
Lecture: 3 hrs/ week **Credit: 3.00**

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

Electricity and Magnetism: Electric charge, Coulomb’s law, the electric field electric flux and Gauss’s law, some application of Gauss’s law, electric potential V, relation between E and V, electrical potential energy. Capacitors, capacitance, dielectrics: an atomic view, dielectrics and Gauss' law.

Current and resistance: current and current density, Ohm's law, Ampere's law, Faraday's law, Lenz's law, self-inductance and mutual inductance. Magnetic properties of matter: magnetomotive force, magnetic field intensity, permeability, susceptibility, classifications of magnetic materials, magnetization curves.

Modern Physics: Michelson Morley's experiment, Gallilean transformation, special theory of relativity, Lorentz-transformation, relative velocity, length contraction, time dilation, mass energy relation. Photoelectric effect, Compton effect, De-Broglie wave, Bohr's atom model. Nuclear Physics: Radioactive decay, half life, mean life, isotopes, nuclear binding energy, alpha, beta and gamma decay.

PH 104 Physics Sessional -II
Lecture: 1.5 hrs/ week **Credit: 0.75**

Laboratory Experiment:

Determination of the radius of curvature of a plano-convex lens by Newton's ring method. Determination of threshold frequency for the photoelectric effect of a photocathode and the value of the Planck's constant. To plot thermoelectromotive force-temperature (calibration) curve for a given thermocouple. Determination of the melting point of a solid using the calibration curve. Determination of the specific rotation of sugar solution by a polarimeter. Determination of the temperature coefficient of the resistance of the material of a wire. Measurement of unknown resistance and verification of the laws of resistance by P.O. (post office) box. Comparison of the E.M.F's of two cells by potentiometer.

Math 103 Mathematics-II
Lecture: 3 hrs/ week **Credit: 3.00**

Matrices: Definition of matrix, Algebra of matrices. Multiplication of matrices. Transpose of a matrix and inverse of a matrix. Rank and elementary transformation of matrices. Solution of linear equations. Linear dependence and independence of vector. Quadratic forms. Matrix polynomials. Determination of characteristic roots and vectors. Null space and nullity of a matrix. Characteristic subspace of a matrix.

Two and three-dimensional Co-ordinate Geometry: A pair of straight lines and conic section in two dimensions. System of co-ordinate. Projection. Direction Cosines. Equations of planes and lines. Angle between lines and planes. Distance from a point to a plane. Co-planar lines. Shortest distance between two given straight lines. Standard equation of conicoids, sphere ellipsoid. Hyperboloid of one sheet, hyperboloid of two sheets. Tangent planes. Normal lines. Condition of tangency.

Syllabus
of
Courses Offered in 2nd Year
B.Sc. Engineering

SEMESTER - III

SL No.	Course No.	Course Title	Contact Hours/ Week	Credit
1.	CE 203	Engineering Materials	4	4
2.	CE 211	Mechanics of Material-I	3	3
3.	CE 221	Fluid Mechanics-I	4	4
4.	Math 201	Mathematics -III	4	4
5.	Hum 201	Sociology and Government	2	2
6.	CE 204	Engineering Materials Sessional	3	1.5
7.	CE 210	Details of Constructions	3	1.5
8.	CE 222	Fluid Mechanics Sessional -1	3	1.5
Total			**26**	**21.5**

No. of Theory Courses = 05
No. of Sessional Courses = 03

Total Contact Hour =26
Total Credit =21.5

SEMESTER - IV

SL No.	Course No.	Course Title	Contact Hours/ Week	Credit
1.	CE 205	Numerical Methods & Computer Programming	4	4
2.	CE 207	Geology and Geomorphology	2	2
3.	CE 213	Mechanics of Material-II	3	3
4.	Math 203	Mathematics – IV	4	4
5.	Hum 203	Accounting & Economics	3	3
6.	CE 206	Numerical Methods & Computer Programming Sessional	3	1.5
7.	CE 214	Mechanics of Material Sessional-II	3	1.5
8.	CE 220	Details of Estimating	1.5	0.75
Total			**23.5**	**19.75**

No. of Theory Courses = 05
No. of Sessional Courses = 03

Total Contact Hour = 23.50
Total Credit =19.75

SEMESTER - III

CE 203 Engineering Materials
Lecture: 4 hrs/ week **Credit: 4.00**

Brick: Constituents of brick clay, characteristics, specifications, classification and uses of bricks, efflorescence.

Aggregate: Classification and properties of aggregate, grading of aggregate, testing of aggregate, classification, properties, tests and function of sand.

Cement: Point of difference between cement and lime, composition of ordinary cement, functions of various ingredients of cement, physical properties of Portland cement, types and tests of cement.

Mortar and plaster: Types of mortar, functions of sand and surki in mortar, uses of mortar, preparation of cement mortar, precautions in using mortars, plastering, pointing, white and color washing and distempering.

Concrete: Function of aggregate and water in concrete, segregation, bleeding, properties of concrete, strength and workability of concrete, factors influence the properties of concrete, creep of concrete, chemical attack of concrete, design of concrete mixes.

Corrosion and its prevention, paints, varnishes, properties and uses of rubber, timber plastics and ferrocement.

Atomic structures and bonding, yielding, fracture, elasticity, plasticity.

CE 211 Mechanics of Materials-I
Lecture: 3 hrs/ week **Credit: 3.00**
Prereq. CE 103

Fundamental concept of stress and strain. Mechanical properties of materials, strain energy, stresses and strains in members subjected to tension, compression, shear and temperature changes. Bending moment and shear force diagrams of beams and frames, flexural and shearing stresses in beam, shear flow and shear center. Thin walled pressure containers: riveted and welded Joints.

CE 221 Fluid Mechanics-I
Lecture: 4 hrs/ week **Credit: 4.00**

Development and scope of fluid mechanics fluid properties, Fluid static's Manometers and pressure gages, pressure head, center of pressure, application of hydrostatic forces. Buoyancy and Floatation: Principle of Archimedes's stability of floating body, Metacenter. Kinematics of fluid flow. Fluid flow concept and basic equation continuity equations, Bernoulli's equation, Energy equation, Momentum equation and forces in fluid flow. Similitude and dimensional analysis. Study in compressible flow in pressure conduits, laminar and turbulent flow. Pipe flow: general equation for pipe flow and minor losses in pipe flow. Pipe flow problems: pipe in series and parallels, branching of pipes and pipe networks. Fluid measurements: pitot tube, orifice, mouthpiece, nozzle, venturimeter and Weir.

Math 201 Mathematics-III
Lecture: 4 hrs/ week **Credit: 4.00**

Differential equation: Definition, formation of differential equation and solution of first order ordinary differential equation by various methods. Solution of differential equation of first order and higher degrees. Solution of linear equations of second degree and higher orders with constant co-efficient. Solution of differential equations when the dependent and independent variables are absent. Solution of differential equation in series by the method of Fobenious: Bessel's function, Legendre's polynomials and their properties.

Fourier series and partial differential equation: Fourier series, Periodic functions, odd and even function, evaluation of Fourier co-efficient, Fourier integral, Fourier transforms and their uses to physical problem.
Partial differential equation: Solution of first order partial differential equation by Lagrange method and Charpit method. Definition of harmonics, Laplace equation in Cartesian, polar, cylindrical and spherical co-ordinates.

Hum 201 Sociology & Government
Lecture: 2 hrs/ week **Credit: 2.00**

Sociology: scope, some basic concepts. social evolution and techniques of production, culture and civilization. Social structure of Bangladesh. Population and world resources. Oriental and occidental societies, industrial revolution. Family urbanization and industrialization, urban ecology, co-operative and socialist movements. Rural sociology.

Government: Some basic concepts of government and politics. Functions, organs and forms of modern state government, socialism, Fascism, Marxism, U.N.O. Government and politics of Bangladesh. Some major administrative systems of developed countries. Local self-government.

CE 204 Engineering Materials Sessional
Contact Hours: 3 hrs/ week **Credit: 1.50**

Test of specific gravity, unit weight, moisture content and absorption of coarse and fine aggregate, normal consistency, setting time, direct tensile and compressive strength of cement mortar, gradation of coarse and fine aggregate, design and testing of concrete mix.

CE 210 Details of Construction
Sessional: 3 hrs/ week **Credit: 1.50**

Brick masonry, framed structures, arches and lintels, details of floors and roofs, pointing, plastering and interior finishing. Scaffolding and staging, shoring and underpinning, thermal insulation and acoustics, stairs: types and construction details, specifications of materials for the above constructions.

CE 222 Fluid Mechanics Sessional-I
Contact Hours: 3 hrs/ week **Credit: 1.50**

Center of pressure, proof of Bernoulli's theorem, flow through venturimeter, flow through orifice and mouthpiece, concept of velocity by co-ordinate method, flow though mouthpiece, flow over V-notch, fluid friction in pipes, flow over sharp-crested weir.

SEMESTER - IV

CE 205 Numerical Methods & Computer Programming
Lecture: 4 hrs/ week **Credit: 4.00**

Basic components of computer system, FORTARN and C/C^{++} language, numerical solution of algebraic and transcendental equations, matrices, solution of systems of linear equations, curve-fitting by least squares, finite differences, divided differences, interpolation, computer applications to Civil Engineering problems, numerical differentiation and integration, numerical solution of differential equations.

CE 207 Geology and Geomorphology
Lecture: 2 hrs/ week **Credit: 2.00**

Mineralogy: Identification of minerals, common rock forming minerals, physical properties of minerals.

Mineraloids: Rocks: types of rock, cycle of rock change, sedimentation and metamorphism, earthquake and seismic map of Bangladesh.

Structural Geology: Faults, type of Faults, dome and basin, fold, fold types, Erosional process, quantitative analysis of erosional land forms, land subsidence, land slide.

Geomorphology: Channel development, channel widening, valley shape, stream terraces: channel pattern and river basins, channel morphology, drainage pattern, geology and geomorphology of Bangladesh.

CE 213 Mechanics of Materials-II
Lecture: 3 hrs/ week **Credit: 3.00**
Prereq. CE 211

Torsional stresses in shafts and tubes, helical springs, combined stresses, transformation of stresses. Deflection of beam by direct integration, moment area and conjugate beam methods. Buckling of columns.

Math 203 Mathematics-IV
Lecture: 4 hrs/ week **Credit: 4.00**

Vector analysis: Fundamental of vector algebra, scalar and vector product of two vectors. Triple and multiple products, vector differentiation, gradient, divergence and curl. Vector integration, divergence, Gauss's, Green's and Stoke's theorem and their application.

Laplace transformation: Definition, Laplace transforms of some elementary function. Inverse Laplace transforms. Laplace transforms of derivatives. Solution of differential equation by Laplace transforms.

Statistics: Measures of central tendency, measures of dispersion, moments, skewness and kurtosis. Elementary probability theory and discontinuous probability distribution e.g. Binomial, Poisson and normal elementary sampling theory, estimation and confidence limit, hypothesis testing, correlation and regression analysis.

Hum 203 Accounting & Economics
Lecture: 3 hrs/ week **Credit: 3.00**

Principles of accounting: accounts, transaction, the accounting procedure and financial statements. Cost in general: objectives and classifications. Overhead costing. Cost sheet under job costing operating costing and process costing. Marginal costing: tools and techniques, cost-volume-profit analysis. Relevant costing: analyzing the profitability within the firm, guidelines for decision making. Long-run planning and control: capital budgeting.

Definition of economics. Economics and Engineering. Principles of Economics.

Micro economics: The theory of demand and supply and their elasticity's. Price determination. Nature of an economic theory, applicability of economic theories to the problems of developing countries. Indifference curve technique. Marginal analysis. Optimization. Market. Production, Production function, types of productivity. Rational region of production of an engineering firm. The short run and the long run. Fixed cost and variable cost. Internal and external economics and diseconomies.

Macro-economics: savings, investment. National income analysis. Inflation. Monetary policy, fiscal policy and trade policy with reference to Bangladesh. Planning in Bangladesh.

CE 206 Numerical Methods & Computer Programming Sessional
Contact Hours: 3 hrs/ week **Credit: 1.50**

Operating system for microcomputers, development of FORTRAN programs and solution of problems using a computer, solution of Civil Engineering problems by microcomputers.

CE 214 Mechanics of Materials Sessional -II
Contact Hours: 3 hrs/ week **Credit: 1.50**

Tension test and impact test of mild steel specimen, hardness test of metals, compression test of timber specimen. helical spring test, static bending test, direct shear test and slender column test.

CE 220 Details of Estimating
Sessional: 1.5 hrs/ week **Credit: 0.75**

Detailed estimate of all items of work of a building, details estimate of all items of work of a bridge, truss, culvert and a simple girder bridge.

Syllabus
of
Courses Offered in 3rd Year
B.Sc. Engineering

SEMESTER - V

SL No.	Course No.	Course Title	Contact Hours/ Week	Credit
1	CE 311 Prereq. CE 211	Structural Analysis & Design-I	3.0	3.00
2.	CE 315 Prereq. CE 213	Reinforced Concrete-I	3.0	3.00
3.	CE 321 Prereq. CE 221	Engineering Hydraulics	4.0	4.00
4.	CE 331	Geotechnical Engineering-I	3.0	3.00
5.	CE 341	Environmental Engineering-I	3.0	3.00
6.	CE 312	Structural Analysis & Design Sessional-I	3.0	1.50
7.	CE 322	Engineering Hydraulics Sessional	3/2	0.75
8.	CE 332	Geotechnical Engineering Sessional-I	3/2	0.75
9.	CE 342	Environmental Engineering Sessional-I	3/2	0.75
Total			**23.5**	**19.75**

Prereq. = Prerequisite

No. of Theory Courses = 05
No. of Sessional Courses = 04

Total Contact Hour =23.5
Total Credit = 19.75

SEMESTER - VI

SL No.	Course No.	Course Title	Contact Hours/ Week	Credit
1.	CE 307	Hydrology	3.0	3.0
2.	CE 313 Prereq. CE 311	Structural Analysis & Design-II	3.0	3.0
3.	CE 317 Prereq. CE 315	Reinforced Concrete-II	3.0	3.0
4.	CE 333 Prereq. CE 331	Geotechnical Engineering-II	3.0	3.0
5.	CE 351	Transportation Engineering-I	3.0	3.00
6.	CE 318	Reinforced Concrete Sessional-II	3.0	1.50
7.	CE 334	Geotechnical Engineering Sessional-II	3/2	0.75
8.	CE 352	Transportation Engineering Sessional-I	3/2	0.75
Total			**21**	**18**

Prereq. = Prerequisite

No. of Theory Courses = 05 Total Contact Hour =21
No. of Sessional Courses = 03 Total Credit = 18

SEMESTER - V

CE 311 Structural Analysis and Design-I
Lecture: 3 hrs/ week **Credit: 3.00**
Prereq. CE 213

Stability and determinacy of structures, analysis of statically determinate arches. Influence lines for statically determinate structure: moving loads on beams, frames and trusses. Cable supported structures and space trusses.

CE 312 Structural Analysis and Design Sessional-I
Contact Hour: 3 hrs/ week **Credit: 1.50**

Design of members and connections of a roof truss and a plate girder bridge.

CE 315 Reinforced Concrete-I
Lecture: 3 hrs/ week **Credit: 3.00**

Fundamental behavior of reinforced concrete members, introduction to WSD and USD methods, analysis and design of singly & doubly reinforced beams. T-beams and one way slab according to WSD and USD methods, diagonal tension, bond and anchorage according to WSD and USD methods, lintels, and staircases.

CE 321 Engineering Hydraulics
Lecture: 4 hrs/ week **Credit: 4.00**
Prereq. CE 221

Open channel flow and its classification, velocity and pressure distributions, energy equation, specific energy and transition problems, critical flow and control, principles of flow measurement and devices, concept of uniform flow, Chezy and Mannings equations, estimation of resistance coefficients and computation of uniform flow, momentum equation, hydraulic jump, stilling basin, dams and related structures. Theory and analysis of gradually varied flow, computation of flow profiles, design of channel. Impact of water jet, Principles of hydraulic machines: pumps.

CE 322 Engineering Hydraulics Sessional
Contact Hours: 1.5 hrs/ week **Credit: 0.75**

Experiments on sluice gate, venture flume, Parshall flume, cut-throat flume, hydraulic jump, velocity distribution profile, Manning's roughness coefficient. Specific force and specific energy: pipe surge and water hammer, preparation and analysis of hydrographs, aquifer characteristics and estimation of yield from wells.

CE 331 Geotechnical Engineering-I
Lecture: 3 hrs/ week **Credit: 3.00**

Introduction to Geotechnical Engineering, formation. type and identification of soils, soil composition, soil structure and fabric, index properties of soils, Engineering classification of soils, soil compaction, principles of total and effective stresses, permeability and seepage, capillarity and flow net, shear-strength characteristics of soils, compressibility and settlement behavior of soils.

CE 332 Geotechnical Engineering Sessional-I
Lecture: 1.5 hrs/ week **Credit: 0.75**

Field identification of soil samples, specific gravity test, Atterberg limits test, grain size analysis by sieve and hydrometer, field density test, standard proctor compaction test, modified proctor compaction test, permeability (constant & variable head) test.

CE 341 Environmental Engineering-I
Lecture: 3 hrs/ week **Credit: 3.00**

Introduction to environmental Engineering, community and environment, clean water, sanitation and health, introduction to water supply, population and water requirement.

Water supply sources, ground water and surface water, common water supply systems with specific reference to Bangladesh, different types of hand pumps, installation and O & M of hand pumps, problems of water supply, presence of iron and arsenic, hardness, salinity. Alternative technologies for problem areas in Bangladesh: Shallow Shrouded Tube well (SST), Very Shallow shrouded Tube well (VSST), pond sand Filter (PSF), Deep-set technologies.

Water collection and transportation, head works, pumps and pumping machinery, water distribution system, analysis and design of distribution network, fire hydrants, leak detection, unaccounted for water, alternative technologies, solar stills, rain water harvesting.

Water quality and treatment, water quality parameters and standards, water treatment: plain sedimentation, flocculation and settlement, filtration, disinfection, other treatment methods, small scale iron and arsenic removal units, other low-cost treatment methods for rural communities, monitoring and sanitary protection of water supply distribution system.

Socio-Economic aspects of WSS, Socio-Economy of rural and urban Bangladesh. Demographic characteristics, power structure, cultural issues (traits), rural leadership, local government structure, influence of socio-Economic aspects on community water supply and sanitation, concept of community participation, participatory planning, community organization, community mobilization, sustainable development approach, gender issues conceptual frame, women empowerment, gender auditing, gender balance and sensitivity.

CE 342 Environmental Engineering Sessional-I
Contact Hours: 1.5 hrs/ week **Credit: 0.75**

Physical and chemical tests of water and waste water.

SEMESTER - VI

CE 307 Hydrology
Lecture: 3 hrs/ week **Credit: 3.00**

Introduction: Hydrologic cycle, meteorological aspects of Hydrology, precipitation, water losses, interception, evaporation, transpiration and infiltration. Run off: Factors affecting run off, estimation of run off, stream flow, stream flow hydrograph, overland flow, flood rating, statistical methods in hydrology.

Ground water: Introduction, aquifer properties and ground water flow, well hydraulics, quality of ground water, ground water recharge, design, drilling and construction of water wells.

CE 313 Structural Analysis and Design-II
Lecture: 3 hrs/ week **Credit: 3.00**
Prereq. CE 311

Approximate analysis of statically indeterminate structures, deflection of beams, frames and trusses by virtual work method. Two hinged arches. Introduction to moment distribution method.

CE 317 Reinforced Concrete-II
Lecture: 3 hrs/ week **Credit: 3.00**
Prereq. CE 315

Two way slabs, columns, isolated and combined footings, retaining walls, reinforced concrete floor and roof systems, flat slabs and flat plates, review of codes, plastic hinge idea and collapse mechanism, yield line method. Introduction of prestressed concrete.

CE 318 Reinforced Concrete Sessional-II
Contact Hours: 3 hrs/ week **Credit: 1.50**

Design of a slab bridge and a deck-girder bridge.

CE 333 Geotechnical Engineering-II
Lecture: 3 hrs/ week **Credit: 3.00**
Prereq. CE 331

Soil investigation techniques, direct measurement of consistency and relative density, correlation of strength parameters with N-Values, lateral earth pressure, stress distribution, settlement computation, types of foundations, bearing capacity of shallow and deep foundation, settlement and distortion of foundations and slope stability analysis.

CE 334 Geotechnical Engineering Sessional-II
Contact Hours: 1.5 hrs/ week **Credit: 0.75**

Direct shear test, unconfined compression test, triaxial compression test, relative density test, consolidation test, Field test (SPT).

CE 351 Transportation Engineering-I
Lecture: 3 hrs/ week **Credit: 3.00**

Introduction to transportation engineering, development of transportation system, elements of transportation system, transportation in Bangladesh, transportation planning concepts: collection, study and analysis of basic data. Highway location and surveys. Geometric design of highways: elements of design, cross-section elements, curves and sight distances, road intersections. Traffic engineering: the road/ traffic system, vehicle and traffic characteristics, traffic control devices, traffic studies, parking and roadway lighting,

Highway materials: desirable properties of road aggregate; production, properties and uses of bituminous material

Road safety engineering: Accident data system, Road engineering, Traffic legislation, Traffic enforcement, Driver training & testing, Vehicle safety, Education & publicity, Medical services.

CE 352 Transportation Engineering Sessional-I
Lecture: 1.5 hrs/ week **Credit: 0.75**

Roadway capacity studies, Tests on road aggregate, Tests on bituminous material.

Syllabus
of
Courses Offered in 4th Year
B.Sc. Engineering

SEMESTER - VII

SL No.	Course No.	Course Title	Contact hour/ Week	Credit
1.	CE 411 Prereq. CE 313	Structural Analysis & Design-III	4.0	4.00
2.	CE 421 Prereq. CE 321	Irrigation and Flood Control	3.0	3.00
3.	CE 431 Prereq. CE 333	Geotechnical Engineering-III	3.0	3.00
4.	CE 441 Prereq. CE 341	Environmental Engineering-II	3.0	3.0
5.	CE 451 Prereq. CE 351	Transportation Engineering-II	3.0	3.0
6.	CE 412	Structural Analysis & Design Sessional-III	3.0	1.5
7.	CE 442	Environmental Engineering Sessional-II	1.5	0.75
8.	CE 452	Transportation Engineering Sessional-II	1.5	0.75
9.	*CE 400	Project & Thesis	6.0	1.5
Total			**28.0**	**20.50**

* This Credit will be assessed at the end of 8th semester.

No. of Theory Courses = 05 Total Contact Hour = 28.0
No. of Sessional Courses = 04 Total Credit = 20.50

SEMESTER - VIII

Option	Course No.	Course Title	Theory	
			Contact Hours/ Week	Credit
1	CE 401	Project Planning & Construction Management	3.0	3.00
2	CE 413	Pre-stressed Concrete	2.0	2.00
	CE 415	Theory of Elasticity and Elastic Instability of Structures	2.0	2.00
	CE 417	Finite Element Method	2.0	2.00
	CE 419	Structural Dynamics	2.0	2.00
	CE 461	Design of Steel Structures	2.0	2.00
	CE 410	Structural Analysis and Design Sessional -III	3.0	1.5
	CE 412	Structural Analysis & Design Sessional-IV	3.0	1.5
3	CE 420	Water Resources Engineering Sessional-I	3.0	1.50
	CE 423	River Engineering	2.0	2.00
	CE 425	Coastal Engineering	2.0	2.00
	CE 427	Hydraulic Structures	2.0	2.00
	CE 429	Ground Water Engineering	2.0	2.00
4	CE 430	Geotechnical Engineering Sessional-III	3.0	1.5
	CE 433	Geotechnical Engineering-IV	2.0	2.00
	CE 435	Geotechnical Engineering-V	2.0	2.00
	CE 437	Geotechnical Engineering-VI	2.0	2.00
5	CE 440	Environmental Engineering Sessional-III	3.0	1.5
	CE 443	Environmental Pollution Control	2.0	2.00
	CE 445	Solid Waste Management	2.0	2.00
	CE 447	Environmental Development Project	2.0	2.00
6	CE 450	Transportation Engineering Sessional-III	3.0	1.5
	CE 453	Transportation Engineering-III	2.0	2.00
	CE 455	Transportation Engineering-IV	2.0	2.00
	CE 457	Transportation Engineering-V	2.0	2.00
7	CE 403	Professional Practices & Communication Skills	2.0	2.00
	CE 405	Socio-Economic Aspects of Development Project	2.0	2.00
8	CE 400	Project & Thesis	6.0	3.0

N.B. 1 & 8-Compulsory course, (2-7) - Optional course. Students shall take one optional thesis related theory course & the corresponding sessional course from any optional group of 2-6 and three more optional theory courses from other options of 2-7 but not more than one from each option & another corresponding sessional course.

No. of Theory Courses = 05 Total Contact Hour = 32

No. of Sessional Courses = 06 Total Credit = 21.5

SEMESTER - VII

CE 411 Structural Analysis and Design-III
Lecture: 4 hrs/ week **Credit: 4.00**
Prereq. CE 313

Analysis of statically indeterminate structures by displacement method, slope deflection and moment distribution method**.** Analysis of composite structures. Influence lines for statically indeterminate beams, frames, arches and grids. Stiffness matrix, member stiffness, stiffness transformation, assembly of stiffness matrices & solution for beams, frames and plane trusses and flexibility matrix.

CE 411 Structural Analysis and Design Sessional-III
Contact Hours: 3 hrs/ week **Credit: 1.50**

Principles of different types of bridges over rivers and wide canals, detailed design of a balanced cantilever bridge.

CE 421 Irrigation and Flood Engineering
Lecture: 3 hrs/ week **Credit: 3.00**
Prereq. CE 321
Irrigation:

Importance of irrigation: source and quality of irrigation water, soil-water relationship, consumptive use, estimation of irrigation water requirements and irrigation scheduling and methods of irrigation. Design of irrigation canal system, irrigation structures and irrigation devices. Water logging, salinity and reclamation. Problems of irrigated land, irrigation projects and institutional constraints.

Flood Engineering:
Flood and its causes, Methods of flood management, structural and non-structural measures, 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.

CE 431 Geotechnical Engineering-III
Lecture: 3 hrs/ week **Credit: 3.00**
Prereq. CE 333

Foundation Engineering: report and selection of type of foundation, design and construction of mat and pile foundations. Sheet pilling wall, caissons and cofferdam. Introduction to soil improvement techniques, Design criteria for machine foundation and cofferdam.

CE 441 Environmental Engineering-II
Lecture: 3 hrs/ week **Credit: 3.00**
Prereq. CE 341

Environmental sanitation, introduction to environmental sanitation, environmental pollution, environmental protection and management, sanitation practices in Bangladesh, different sanitation options-various types of pit latrines. Pour flush latrines etc., upgrading of existing systems, construction and maintenance of sanitation facilities, sanitation for densely populated area, community latrine cum bio-gas plant, design and construction of septic tank and soak well, building sanitation, code of practice.

Wastewater, estimation of wastewater, wastewater collection system, hydraulics of sewer, design, construction and maintenance of sanitary sewer and storm drainage system, microbiology of wastewater, preparatory, primary and secondary treatment waste stabilization ponds and other methods and disposal of waste water, aquaculture as treatment option, small bore sewer system, treatment and disposal of industrial effluents.
Health & hygiene: Disease description, transmission and control, hygiene education, scope and methodology, social mobilization for hygiene practice, integrated approach for water, sanitation and health education.

CE 442 Environmental Engineering Sessional-II
Contact Hours: 1.5 hrs/ week **Credit: 0.75**

Bacteriological tests of water, design of water supply system.

CE 451 Transportation Engineering-II
Lecture: 3 hrs/ week **Credit: 3.00**
Prereq. CE 351

Sub-grade, sub-base and base courses, soil stabilization and soil aggregates in road constructions, low-cost roads, mix design methods, design, construction and maintenance of flexible and rigid road pavements, equipment.
Railways: general requirements, alignment, permanent way, station and yards. signaling, points and crossings, maintenance.

Waterways: Introduction, harbors, ports, docks, coastal structure

CE 452 Transportation Engineering Sessional-II
Contact Hours: 1.5 hrs/ week **Credit: 0.75**

Tests on sub-grade, sub-base and base materials, Mix design Method for bituminous concrete

CE 400 Project and Thesis
Hours/ week: 6 **Credit: 1.50**

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

SEMESTER - VIII

CE 401 Project Planning & Construction Management
Lecture: 3 hrs/ week **Credit: 3.00**

Principles of Management, Principles of construction management, construction contracts and specifications, inspection and quality control, construction safety, construction planning and scheduling, PERT, CPM, case studies, resource scheduling, PERT: a cost accounting system, linear programming, decision making and simulation, psychology in administration, materials management, demand forecasting, inventory control, personnel management, stores management, procurement, project planning and evaluation, feasibility reports, cash flow, pay back period, internal rate of return, benefit-cost ratio, construction equipment and plants, replacement studies.

CE 403 Professional Practices and Communication Skills
Lecture: 2 hrs/ week **Credit: 2.00**

The project cycle, project proposal, contractual provisions, techniques of specification writing, evaluation of bids, project evaluation.

Interpretation of literature, documents etc., communicating, preparation of report, industrial and labour relations, professional ethics in Civil Engineering.

CE 405 Socio-Economic Aspects of Development Projects
Lecture: 2 hrs/ week **Credit: 2.00**

Economic and social structure, development and economic growth, socio-economic indicators, population, prosperity and poverty, employment of work force, population displacement, rehabilitation strategy, productivity, land loss, land use and land ownership patterns, fisheries and aqua culture, deforestation and afforestation, communication, commerce, industries and other economic benefits, water supply, sanitation, health and nutrition, inequalities in distribution of benefits and losses, socio-economic survey, case studies.

CE 407 Integrated Water Resources Planning and Management
Lecture: 2 hrs/ week **Credit: 2.00**

Basic concepts in integrated water resources management. Economic, environmental and industrial aspects. Participation of beneficiaries. Formation of users group. Fisheries management. Strategic planning. System analysis approach: Conceptual framework and models. Analytical techniques.

CE 410 Structural Analysis and Design Sessional-III
Lecture: 3 hrs/ week **Credit: 1.50**

Introduction to tall buildings in different countries of the world, design of high rise compression members by WSD and USD methods. Design of beam, beam-columns and joint.

CE 412 Structural Analysis and Design Sessional-IV
Sessional: 3 hrs/ week **Credit: 1.50**

Design of various reinforced concrete structures e.g. water tower, folded plate roof etc.

CE 413 Prestressed Concrete
Lecture: 2 hrs/ week **Credit: 2.00**

Prestressed concrete: materials, prestressing systems, loss of prestress, analysis of sections for flexure, shear, bond and bearing, beam deflections and cable layout, partial prestress, design of prestressed sections for flexure, shear, bond and bearing. Analysis and design of prestressed beam section.

CE 415 Theory of Elasticity and Elastic Instability of Structures
Lecture: 2 hrs/ week **Credit: 2.00**

Introduction to theory of elasticity, plane stress and plane strain condition, two dimensional problems in rectangular and polar coordinates, torsion of circular and non-circular shafts, instability of structures, stability functions.

CE 417 Finite Element Method
Lecture: 2 hrs/ week **Credit: 2.00**

Introduction to finite element method as applied to Civil Engineering problems. One dimensional stress deformation and time dependent flow problem. Analysis of two dimensional plane stress and plane strain problems.

CE 419 Structural Dynamics
Lecture: 2 hrs/ week **Credit: 2.00**

Formulation of equation of motion, free vibration response, SDOF and MDOF systems, response to harmonic and impulse loading and vibration analysis by Rayleigh's method.

CE 420 Water Resources Engineering Sessional-I
Sessional: 3 hrs/ week **Credit: 1.50**

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

CE 423 River Engineering
Lecture: 2 hrs/ week **Credit: 2.00**

Behavior of alluvial rivers. River channel pattern and fluvial processes. Aggradation and degradation, local scours, river training and bank protection works. Navigation and dredging. Sediment movement in river channels, bed forms and flow regimes.

CE 425 Coastal Engineering
Lecture: 2 hrs/ week **Credit: 2.00**

Coast and coastal features. Tides and currents. Tidal flow measurement. Waves and storm surges. Docks and labor. Forces of waves and fides in the design of coastal and harbor structures.

Coastal sedimentation processes. Deltas and estuaries. Shore protection works. Dredging and dredgers.

CE 427 Hydraulic Structures
Lecture: 2 hrs/ week **Credit: 2.00**

Principles of design o hydraulic structures, types of hydraulic structures. Design of dams, barrages, weirs, spillways, energy dissipaters and spillway gates. Cross drainage works.

CE 429 Ground Water Engineering
Lecture: 2 hrs/ week **Credit: 2.00**

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

CE 430 Geotechnical Engineering Sessional-III
Sessional: 3 hrs/ week **Credit: 1.50**
Interpretation of soil test results and design of foundation.

CE 433 Geotechnical Engineering-IV
Lecture: 2 hrs/ week **Credit: 2.00**
Prereq. CE 333

Foundation for structures subjected to lateral loads, retaining walls and abutments, operation and methods of construction, de-watering and slurry-wall construction. Flexible earth retaining structures, sheet piles, cofferdams, caissons, machine foundations, elementary vibrations, shear modulus and elastic constants, foundation design for vibration, fundamentals of soil liquefaction.

CE 435 Geotechnical Engineering-V
Lecture: 2 hrs/ week **Credit: 2.00**

Introduction to critical state soil mechanics, SHANSEP and stress path methods, stress deformation and failure of soil masses. One, two and three dimensional consolidation problem, pore pressure coefficients, soil structure-interaction, earthquake and liquefaction problems, soil improvement, numerical solution of Geotechnical Engineering problems.

CE 437 Geotechnical Engineering-VI
Lecture: 2 hrs/ week **Credit: 2.00**

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

CE 440 Environmental Engineering Sessional-III
Sessional: 3 hrs/ week **Credit: 1.50**

Design of sewerage systems, field visits/ assignments on existing water supply and sanitation technologies, case study on user's participation, O & M practices and ownership, community managed projects.

CE 443 Environmental Pollution Control
Lecture: 2 hrs/ week **Credit: 2.00**

Environment Pollution and its control: Water pollution-source and types of pollutants, waste assimilation capacity of streams, dissolved oxygen modeling, ecological balance of streams, industrial pollution, heavy metal contamination, detergent pollution and eutrophication, ground water pollution, marine pollution control measures-water quality monitoring and management.

Air pollution: Sources and type of pollutants, effects of various pollutants on human health, material and plants, air pollution meteorology, global warming and greenhouse effects, air pollution monitoring and control measures, noise pollution and its effects, ozone layer depletion and acid rain.

CE 445 Solid Waste Management
Lecture: 2 hrs/ week **Credit: 2.00**

Sources and types of solid wastes, physical and chemical properties of solid wastes, solid wastes generation, on -site handling, storage and processing, collection of solid wastes, community and municipal collection systems, transfer station and transport, ultimate disposal methods, recycling and resources recovery, soil pollution, industrial solid waste collection and disposal, hazardous waste management.

CE 447 Environmental Development Project
Lecture: 2 hrs/ week **Credit: 2.00**

Environment and sustainable development, environmental policies and legislation, environmental implication of sectoral development, environmental quality standards, environmental issues and priorities, environmental impact assessment of development schemes, baseline studies, assessment methodologies, economics of environmental management, special topics.

CE 450 Transportation Engineering Sessional-III
Sessional: 3 hrs/ week **Credit: 1.50**
Prereq. CE 451

Design of flexible and rigid highway and air field pavements, geometric design: Roadway intersections, capacity calculation, traffic studies and design.

CE 451 Transportation Engineering-III
Lecture: 2 hrs/ week **Credit: 2.00**
Prereq. CE 351

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

CE 453 Transportation Engineering-IV
Lecture: 2 hrs/ week **Credit: 2.00**

Highways drainage and drainage structures. Evaluation and strengthening of pavements, importance, advantages and trends in air transportation, planning and design of airports, aircraft characteristics related to airport design, types and elements of airport planning studies, airport configuration, geometric design of the

landing area, terminal area, heliports, design of airport pavements, lighting, marking and signing, airport drainage.

CE 455 Transportation Engineering-V
Lecture: 2 hrs/ week **Credit: 2.00**

Highway needs study, highway planning, economics and financing, evaluation and analysis of transportation projects, management, monitoring, organization and implementation of transportation projects, selected case studies, traffic engineering administration and legislation, urban public transportation and freight movement.

CE 461 Design of Steel Structures
Sessional: 2 hrs/ week **Credit: 2.00**

Behavior of structural steel members and steel frames, code requirements, design of tension and compression members by WSD and USD methods, design of beam. Beam-columns, joint design.

Prerequisite Courses: The list of prerequisite courses are given below-

Course No.	Course Title	Prerequisite	
		Course No.	Course Title
CE 211	Mechanics of Materials-I	CE 103	Engineering Mechanics
CE 213	Mechanics of Materials-II	CE 211	Mechanics of Materials-I
CE 311	Structural Analysis & Design-I	CE 213	Mechanics of Materials-II
CE 321	Engineering Hydraulics	CE 221	Fluid Mechanics-I
CE 313	Structural Analysis & Design-II	CE 311	Structural Analysis & Design-I
CE 317	Reinforced Concrete-II	CE 315	Reinforced Concrete-I
CE 333	Geotechnical Engineering-II	CE 331	Geotechnical Engineering-I
CE 411	Structural Analysis & Design-III	CE 313	Structural Analysis & Design-II
CE 421	Irrigation and Flood Engineering	CE 321	Engineering Hydraulics
CE 431	Geotechnical Engineering-III	CE 333	Geotechnical Engineering-II
CE 441	Environmental Engineering-II	CE 341	Environmental Engineering-I
CE 451	Transportation Engineering-II	CE 351	Transportation Engineering-I

Chapter - IV

Academic Ordinance for the Postgraduate Studies Leading to M.Sc. Engg. / M. Engg. / Ph.D. Degree

Academic Ordinance for Postgraduate Studies for the Award of Master of Science in Engineering/ Master of Engineering/ Master of Philosophy/ Doctor of Philosophy Degree

1. Definitions

1.1 'Syndicate' means the Syndicate of the University.

1.2 'Academic Council' means the Academic Council of the University.

1.3 'PGAC' means the Post-Graduate Academic Committee in a degree awarding department of the University.

1.4 'DSC' means the Doctoral Scrutiny Committee.

1.5 'University' means Rajshahi University of Engineering & Technology, abbreviated as RUET, Rajshahi.

1.6 'CASR' means the Committee for Advanced Studies and Research of the University.

According to 31st syndicate meeting CASR shall consist of the following members:

1.	Vice-Chancellor	-Chairman
2.	Pro Vice-Chancellor	- Member
3.	Director (Research and Extension)	- Member secretary
4.	All Deans	- Member
5.	All Heads of the degree awarding department	- Member
6.	Two Professors nominated by Academic Council	- Member
7.	Two Expert members nominated by the Vice-Chancellor	- Member

Vice-Chancellor will nominate one secretary of the CASR
At Least 40% members will fulfill the quorum.

2. Degrees Offered

The post graduate degrees to be offered under this ordinance are as follows:

2.1 Master of Science in

i) Civil Engineering abbreviated as M. Sc. Engg. (CE).
ii) Electrical & Electronic Engineering abbreviated as M.Sc.Engg. (EEE).
iii) Mechanical Engineering abbreviated as M.Sc. Engg. (ME).
iv) Computer Science and Engineering abbreviated as M.Sc Engg. (CSE)

2.2 Master of Engineering in

i) Civil Engineering abbreviated as M. Engg. (CE).
ii) Electrical & Electronic Engineering abbreviated as M. Engg. (EEE).
iii) Mechanical Engineering abbreviated as M. Engg. (ME).
iv) Computer Science and Engineering abbreviated as M. Engg. (CSE).

2.3 Master of Philosophy in

i) Mathematics abbreviated as M. Phil (Math)
ii) Physics abbreviated as M. Phil (Phy)
iii) Chemistry abbreviated as M. Phil (Chem)

2.4 Doctor of Philosophy in

i) Civil Engineering abbreviated as Ph.D. (CE)
ii) Electrical & Electronic Engineering abbreviated as Ph.D. (EEE)
iii) Mechanical Engineering abbreviated as Ph.D. (ME)
iv) Computer Science and Engineering abbreviated as Ph.D. (CSE)
v) Mathematics abbreviated as Ph.D. (Math)
vi) Physics abbreviated as Ph.D. (Phy)
vii) Chemistry abbreviated as Ph.D. (Chem)

The above degree may be offered in any other discipline approved by Syndicate on the recommendation of the Academic Council.

3. Admission

3.1 For admission to the courses leading to the award of the Degree of M. Sc. Engg./ M. Engg. in any branch, a candidate must have a B. Sc. Engg. or an equivalent degree in the relevant/ related field with good academic records from any recognized Institute/ University.

3.2 For admission to the courses leading to the award of M. Phil degree in any branch of Science, a student must have an M. Sc. degree in the

relevant branch or equivalent degree from any recognized Institution or University with good academic record (No third class/ division in any level of study).

3.3 For admission to the courses leading to the award of Ph.D. degree in any branch, a candidate must have an M. Sc Engg./ M. Engg./ M. Phil or an equivalent degree in the relevant branch from any recognized Institution or University with good academic record. A student in M. Sc. Engg./ M. Engg./ M. Phil program may be transferred to Ph.D. program if he shows excellent progress in Masters Thesis after completion of courses evaluated by thesis examination committee and approved by Academic Council on the recommendation of PGAC and CASR.

3.4 Application for admission to the above courses shall be invited through regular means of advertisement and shall be received through prescribed application from.

3.5 On the recommendation of PGAC, the rules for admission into various departments of the University for post-graduate Studies may be amended from time to time by the Academic council through CASR.

3.6 For admission a candidate may be required to appear at a written/ oral test conducted by a Selection Committee as constituted by the respective PGAC.

3.7 Every selected candidate shall get himself registered with the University.

3.8 Each student shall be assigned by the respective PGAC, an adviser from the teachers of the department, not below the rank of an Assistant Professor. Prior to each enrollment and course registration for any semester, the Adviser/ Supervisor (as appointed by Articles 8/10 of this Ordinance) shall check and approve the student's schedule for subjects, Prerequisites as recommended by the Selection Committee and total credit hours.

3.9 Every registered candidate shall get himself enrolled on payment of prescribed fees and other dues before the commencement of each semester.

3.10 Eligibility for the admission of foreign students in the aforementioned post-graduate program will be examined by the equivalence committee.

4. Academic Regulations

4.1 The minimum duration of the M.Sc. Engg./ M. Engg./ M. Phil course shall be of three semesters. A candidate for the masters degree must complete all requirements for the degree within Five academic years from the date of his first admission.

4.2 The minimum duration of the Ph.D. course shall be of Six semesters. A student must complete all the requirements for Ph.D. degree with in seven academic years from the date of his first admission.

4.3 Duration of each semester shall not be less than 24 weeks. Including course registration and semester and examination. There shall be two semesters in one academic year.

4.4 Academic progress shall be measured in terms of credit hours earned by a student. One credit hour for theory course shall normally require one hour of class attendance per week for one semester. While one credit hour for thesis, project or laboratory class should normally require three hours of work per week for one semester. The number of credit hours for each subject shall be as specified in the syllabus of the respective department.

4.5 Minimum requirements of the theory and thesis/ project credit hours to be earned by a student for different degrees are as outline in the following table:

Degree	**Theory**	**Thesis**	**Project**	**Total**
M.Sc. Engg.	18	18	-	36
M. Engg.	30	-	6	36
M. Phil.	24	24	-	48
Ph. D	9	45	-	54

4.6 There shall be two categories of students, namely full time students and part time students

4.6.1: Students, Serving in different organization may be admitted as part time students with a written consent from the employer. A part time student may be assigned a maximum of 9 credit hours of course work in a semester.

4.6.2: Full time students must register for a minimum of 12 credit hours and a maximum of 15 credit hours per semester. A full time student shall not be allowed to be in the employment of any organization (even as part time employee). However, they may be awarded teaching research assistantship. A student already in employed may be admitted

as full time students only if he is on leave or deputation from his employer.

4.6.3: If a full time student gets an employment while he/ she is in a running semester, he/ she may be allowed to continue the rest of that semester with prior approval of the Head of the department and the employer.

4.7 The subject that shall be offered in any semester shall be as determined by the relevant department.

4.8 After the first semester the PGAC may consider a student's application to transfer the credits earned elsewhere if the following conditions are fulfilled.

i) The credits should be earned from a recognized Institution or University.

ii) Maximum 50% Credit-Hours in course work may be transferred.

iii) Credits earned before Five academic years from the date of application will not be considered.

iv) Only B+ or higher grades will be considered.

The student's performance in the first semester and the standard and application of the courses studies elsewhere should be specially considered in giving such approval.

5. Grading System

5.1 Letter grade system will be applied in assessment of the performance of a student in semester examination. Numerical marking may be made in answer scripts, tests etc. but all final grading to be reported to the Head of the department in prescribed form, shall be in the letter grade system as outlined below.

Marks obtained	Grades	Description	Grade Points
90% and above	A+	Excellent	4.0
80% to below 90%	A	Very good	3.5
70% to below 80%	B+	Good	3.0
60% to below 70%	B	Average	2.5
50% to below 60%	C	Pass	2.0
Below 50%	F	Fail	0.0
	I	Incomplete	
	S	Satisfactory	
	U	Unsatisfactory	
	W	Withdrawn	

F-Subject in which the students get F grades shall not be counted towards credit hour requirements and for the calculation of Grade Point Average (GPA).

I-Given only when a student is unable to complete the course because of circumstances beyond his control. It must be made up by the close of the next two semesters or the incomplete grade becomes a failure. He/ She may however, be allowed to register without further payment of tuition fees for the course.

S-or U- Satisfactory or unsatisfactory. Used only as final grade for thesis/ project and non-credit courses. Grade for thesis or project which will be continuing shall be recorded as 'In progress'. If however, thesis is discontinued "Incomplete" grade shall be recorded.

W-Officially withdrawn from a course. A student must withdraw officially from a course within two working weeks of the commencement of the semester or else his grade in that course shall be recorded as 'F' unless he/ she is eligible to get a grade of I (incomplete). A student may be permitted to withdraw and change his/ her course within the specified period with the approval of his/ her adviser and Head of the department.

5.2 Official withdrawal: A student may withdraw from the program for a total period of Five academic years for Ph.D. student and Three academic years for Masters student, on the recommendation of the supervisor (and co-supervisor, if any) with prior permission from the Head of the department, if he/ she is unable to continue the program due to any unavoidable circumstances of his/ her own or of the University.

Such withdrawal period will be assessed as academic exemption toward article 4.1/ 4.2.

6. Conduct of Examination

6.1 For all post-graduate degrees in Engineering/ Sciences in addition to tests. assignments and/ or examination during the semester as may be given by the teachers(s) concerned, there shall be a written examination at the end of the semester and/ or other tests for each of the subjects offered in a semester. The dates of such examination will be announced by the Head of the respective department at least two weeks before the commencement of the examinations. The final grade in a subject shall be based on the performance in all tests, assignments and/ or examinations.

6.2 Each examiner will submit the final grades obtained by student(s) in each subject in prescribed form to the Head of the department. The Head of the department will appoint tabulators for each semester, subject to the approval of the Vice-Chancellor. Three copies of the tabulation sheet will be prepared for a semester,(i) One for Vice-Chancellor, (ii) One for Controller of Examination and (iii) One for Head of the department.

6.3 Cumulative grades earned by a student shall be announced by the office of the Controller of Examination at the end of each semester. Students may collect a copy of transcript from the Controller of Examination at the end of each semester, on payment of the prescribed fees.

6.4 The respective teacher(s) of each theory course offered in a semester will be the paper setter and script examiner for the semester examination.

7. Qualifying Requirements

7.1 The qualifying requirement of the degree is that a student must earn a minimum grade point average of 2.65 for masters and 2.75 for Ph.D. degree, based on the weighted average in his course work. GPA is calculated as GPA = $\sum(C_i\ Gi) / \sum Ci$, where, Ci is the credit hour in a particular subject and Gi is the grade point corresponding to the grade obtained by the student in that subject. GPA and CGPA will be rounded off to the second place of decimal.

7.2 The C grades up to a maximum of two subjects may be ignored for calculation of grade point average (GPA) at the written request of the student provided he/ she has completed the total course credit hour requirement with a minimum weighted GPA of 2.65 in the remaining subjects. No subject shall be repeated unless it is compulsory requirement of the degree as department by the PGAC. Performance in all the subjects shall be reflected in the transcript.

7.3 If F grade is obtained in three or more subjects by a student, he/ she shall not be allowed to continue the program.

7.4 If the end of the 1st semester, the GPA falls below 2.5 (including C grades) he/ she shall not be allowed to continue the program.

7.5 In addition to successful completion of course work every student shall submit a thesis on his/ her research work or report on his/ her project work fulfilling the requirements as details in Articles 9,10,11 M. Sc. Engg./ M. Phil students should preferably have a publication/ paper.

8. Thesis/ Project for M.Sc. Engg./ M. Engg./ M. Phil

8.1 Research work for a thesis/ project shall be carried out under the supervision of full time teacher who is a member of PGAC to the relevant department. A co-supervisor from within or outside the department/ University may be appointed. The tentative research proposal of thesis/ project and the supervisor and co-supervisor (if any) shall be approved by the CASR on recommendation of PGAC before the completion of course work requirements of the student concerned.

8.2 The research work must be carried out in this University. In special circumstances it may be carried out at a place(s) recommended by the supervisor in consolation with the Head of the department and approved by the CASR.

8.3 A seminar shall have to be presented by M. Sc. Engg./ M. Phil student on the progress of his/ her research work, within the next semester after completion of course work. The Head of the department will keep a record of it send a report to the Vice-Chancellor in prescribed form.

8.4 Every student shall submit to the Head of the department, through his/ her supervisor required number of type written copies of his/ her thesis/ project report in the approved format on or before a date to be fixed by the Head of the department in consultation with the supervisor concerned.

8.5 The student shall certify that the research work was done by his/ her and that the same work has not been submitted elsewhere for any degree or award (except for publication).

8.6 The thesis/ project should demonstrate an evidence of satisfactory knowledge in the field of research undertaken by the student and must be an original contribution to engineering/ science and worth of publication.

8.7 Every student submitting a thesis/ project report in partial fulfillment of the requirement of a degree shall be required to appear at an oral examination , on a date or dates fixed by the Head of the department in consultation with supervisor and must satisfy the examiners that he/ she is capable of intelligently applying the results of this research to the solution of problem, of undertaking independent work, and also afford evidence of satisfactory knowledge related to the theory and technique used in his research work.

8.8 Examination Committee for M. Sc. Engg./ M. Phil thesis: The Head of the department, in consultation with the supervisor shall propose to the Vice-Chancellor for the approval of Academic council a panel of examiners for thesis and oral examination, usually one month before the date of thesis examination. The Examination Committee shall be constituted as follows.

Supervisor	Chairman	
Co-Supervisor	Member	
Head of the department	Member	
One external member from outside the University/ department	External member	Two alternate names should be proposed.
One or two members from within or outside the department, not below the rank of Assistant Professor, having research experience.	Member	Three alternate names should be proposed.

8.9 Examination Committee for M. Engg. Project: The Head of the department, in consultation with the supervisor shall propose to the Vice-Chancellor for the approval of the Academic council a panel of examiners for project and oral examination, usually one month before the date of project examination. The examination committee shall be constituted as follows.

8.10 If an examiner is unable to accept the appointment or has to relinquish his appointment before/ during the examination, the Vice-Chancellor may appoint another examiner in his place in consultation with the Head of the department and the supervisor, without, further reference to the PGAC, subject to the approval of Academic Council.

8.11 The Head of the department will arrange to keep a record of the thesis/ project examination in tabulation sheet and send a report to the Vice-Chancellor in prescribed format, along with the comments of the thesis examiners. In this report he will also confirm that the student has completed the course and other requirements (if any) for the award of the degree.

9. Comprehensive Examination for Ph.D. Student

9.1 Every Ph.D. Student shall appear at a comprehensive examination, ordinarily held soon after the completion of the course requirements. The PGAC will form an examination committee named Doctoral scrutiny Committee (D.S.C) and will be constituted by the supervisor as chairman; co-supervisor, Head of the department, one teacher not below the rank of Assistant Professor from allied field of research and at least two other teachers usually within the department not below the rank of Assistant Professor, as members. The date and time of the comprehensive examination shall be fixed by the PGAC on the request of the supervisor.

9.2 The comprehensive examination shall comprise a written examination and/ or an oral examination to test the knowledge of the student related to the subject (s) of his research and allied field. If s student fails to qualify in a comprehensive examination he shall be given one more chance to appear in the examination as scheduled by the PGAC. The Head of the department will send a report of the comprehensive examination in prescribed form, to the Vice-Chancellor.

10. Thesis for Ph.D. Degree

10.1 Research work for a thesis shall be carried out under the supervision of a full time teacher who is a member of PGAC to the relevant department. A co-supervisor from within or outside the department/ University may be appointed. The title of thesis and the supervisor and co-supervisor (if any) shall be approved by the PGAC before the completion of course requirements of the student concerned, on the recommendation of the Head of the department.

10.2 The Research work must be carried out in this University. In special circumstances it may be carried out at a place (s) recommended by the supervisor in consultation with the Head of the department and approved by the CASR.

10.3 A seminar shall have to be presented by the student after passing the comprehensive examination. The seminar will show the evidences that the research work selected by the student is compatible towards the award of a Ph.D. degree as will be evaluated by the DSC. The Head of

the department will keep a record of it and send a report to the Vice-Chancellor in prescribed form.

10.4 Open seminar: Before submitting the thesis, the student will present the open seminar, showing the achievements in the research towards the award of Ph.D. degree as will be evaluated by the DSC. The Head of the department will keep a record of it and send a report to the Vice-Chancellor in prescribed form.

10.5 Every student shall submit required number of copies synopsis and thesis in prescribed format to the Head of the department, through his/ her supervisor for distribution among the members of the examination committee and the experts.

10.6 The student shall certify that the research work was done by him/ her and that the work has not been submitted elsewhere for degree or award (except publication).

10.7 The supervisor, in consultation with the Head of the department, will propose a panel of 6 names of the experts in the related field of research from outside the department, at least 3 of which should be from outside the country, to the Vice-Chancellor.

10.8 The Vice-Chancellor will send the copies of the synopsis to the experts' proposed by the supervisor, seeking their consent to be external examiner for the thesis. On receipt of their consent, he will select two external expert members of whom one outside from outside the country and send the copies of the thesis to them. Expert's report in prescribed form should be collected.

10.9 Copies of the experts' reports may be given to the student through the supervisor, if there are any further queries to be cleared or questions to be answered by the student. Such answers should be directly sent to the expert concerned and final report should be collected.

10.10 The thesis should demonstrate and evidence of satisfactory knowledge in the field of research undertaken by the student and must be an original contribution to engineering/ science and worthy of publication. In support of this the student should have at least two publications in journal of International standard.

10.11 Every Student submitting a thesis in partial fulfillment of the requirement of a Ph.D. degree shall be required to appear at an oral examination, on a data or dates fixed by the Head of the department in consultation with supervisor and must satisfy the examiners that he is capable of intelligently applying the results of this research to the solution of problems, of undertaking independent work, and also afford evidence of satisfactory knowledge related to the theory and technique used in his research work.

10.12 On receipt of favorable experts' report the Head of the department, in consultation with the supervisor shall propose to the Vice-Chancellor, for the approval of Academic Council, a panel of examiners for thesis and oral examination, usually one month before the date of thesis examination. The Examination Committee approved by CASR shall be constituted with the following members as described below.

Supervisor	Chairman
Other members of D.S.C	Members
One external member from outside the University.	External Member

10.13 If an examiner is unable to accept the appointment or has to relinquish his appointment before/ during the examination, the Vice-Chancellor may appoint another examiner in his place in consultation with the Head of the department and the supervisor.

10.14 A Student who has been transferred to the Ph.D. program from the masters program may be awarded master's degree, on recommendation of the supervisor, if the student fails to qualify for the award of the Ph.D. degree. In that case that student must have to fulfill all the requirements for the said degree.

10.15 The Head of the department will arrange to keep a record of the thesis examination in tabulation sheet and send a report to the Vice-Chancellor in prescribed format, along with the comments (if any) of the members of the examination committee. In this report he will also confirm that the student has completed the course and other requirements (if any) for the award of the degree.

11. Cancellation of Studentship

i) Non-payment of dues within prescribed period.
ii) Failing to proceed with the program as prescribed by this ordinance.
iii) Failing to make satisfactory progress as reported by the adviser/ supervisor through the PGAC and approved by the Academic Council.
iv) Forced to discontinue his studies under disciplinary rules.
v) Withdrawn officially from all the course works including thesis/ project.

12. Academic Fees

Academic fees will be prescribed by the appropriate authority of this University from time to time.

Chapter - V

Course Structure of the Postgraduate Program

COURSES OFFERED BY THE DEPARTMENT OF CIVIL ENGINEERING

A description of courses currently offered by the Civil Engineering Department is provided below. It should be noted that postgraduate course curricula are updated on a regular basis and new courses are added to the curricula from time to time.

Revised Course Structure for Postgraduate Programs of the Department of Civil Engineering

Compulsory Courses		
Course No.	**Course Title**	**Credit**
CE 6000	Thesis/ Project	18/ 6
Elective Courses		
Course No.	**Course Title**	**Credit**
Division of Structural Engineering		
CE 6101	Boundary Element Method	3
CE 6102	Theory of Elasticity	3
CE 6103	Theory of Plates	3
CE 6104	Plastic Design of Structures	3
CE 6105	Elastic Stability of Structures	3
CE 6106	Finite Element Methods	3
CE 6107	Computer Methods in Civil Engineering	3
CE 6108	Advanced Design of Concrete Structures	3
CE 6109	Analysis and Design of Tall Buildings	3
CE 6110	Finite Element Methods II	3

CE 6111	Structural Dynamics and Seismic Design of Structures	3
CE 6112	Structural Brickwork	3
CE 6113	Advanced Theory and Design of Steel Structures	3
CE 6114	Advanced Concrete Technology	3
CE 6115	Theory and Design of Structural Concrete	3
MATH 6101	Advance Engineering Mathematics	
Division of Water Resources Engineering		
CE 6201	Advanced Fluid Mechanics I	3
CE 6202	Advanced Fluid Mechanics II	3
CE 6203	Open Channel Flow	3
CE 6204	Advanced Hydrology	3
CE 6205	Statistical methods in Hydrology	3
CE 6206	Advance Ground Water Hydraulics	3
CE 6207	Flow through Porous Media	3
CE 6208	Irrigation and Drainage Engineering	3
CE 6209	River Engineering	3
CE 6210	Sediment Transport	3
CE 6211	Hydro-Power Engineering	3
CE 6212	Hydraulic Structures	3
CE 6213	Photogrammetry in Water Resource	3
CE 6214	Development of Water Resources Project	3
CE 6215	Analysis of Water Resource System	3
CE 6216	Physical Modeling and Hydraulic Similitudes	3
CE 6217	Mathematical Modeling	3
CE 6218	Coastal Engineering	3
CE 6219	Tidal and Estuarine Hydraulics	3
CE 6220	Computational River Morphology	3

Division of Geotechnical Engineering		
CE 6301	Soil Mechanics I	3
CE 6302	Soil Mechanics II	3
CE 6303	Foundation Analysis Methods	3
CE 6304	Earth Pressure and Retaining Structures	3
CE 6305	Earth Dams and Stability of Slopes	3
CE 6306	Rock Mechanics	3
CE 6307	Soil Dynamics	3
CE 6308	Advance Engineering Geology	3
CE 6309	Reinforced Earth	3
CE 6310	Constitutive Modelling in Soil Mechanics	3
CE 6311	Advanced Soil Mechanics	3
CE 6312	Earthquake Engineering	3
Division of Environmental Engineering		
CE 6401	Theory of Water Treatment	3
CE 6402	Theory of Sewage Treatment	3
CE 6403	Biology of Sewage and Polluted Waters	3
CE 6404	Environmental Sanitation	3
CE 6405	Industrial Water and Waste Treatment	3
CE 6406	Municipal and Rural Sanitation	3
CE 6407	Water Pollution and Its Control	3
CE 6408	Water Supply Engineering and Design	3
CE 6409	Sewerage and Drainage Engineering Design	3
CE 6410	Environment Management	3
CE 6411	Environment Impact Assessment (EIA)	3
CE 6412	Surface Water Quality Modelling	3
CE 6413	Environmental Fluid Dynamics	3

CE 6414	Aquatic Chemistry for Environmental Engineers	3
Division of Transportation Engineering		
CE 6501	Transportation Engineering	3
CE 6502	Geometric Design of Highways	3
CE 6503	Highway Materials	3
CE 6504	Advanced Surveying	3
CE 6505	Structural Design of Pavements	3
CE 6506	Traffic Engineering	3
CE 6507	Railway Engineering	3
CE 6508	Waterways	3
CE 6509	Planning and Design of Airports	3
CE 6510	Transportation Planning	3
CE 6511	Transportation Engineering Economics	3
CE 6512	Traffic Simulation	3
CE 6513	GIS and Remote Sensing in Transportation	3

DIVISION OF STRUCTURAL ENGINEERING

CE 6101 Boundary Element Method **Credit: 3**

Introduction; One-Dimensional Problems: potential flow, beam bending; Two-dimensional problems of potential flow, Two-dimensional problems of elastostatics; Axisymmetric analysis; Three- dimensional formulations; Parametric representations of functions and geometry; Time-dependent analysis; elastodynamics, transient groundwater flow; Non-linear analysis: Problems of elastoplasticity; Combination of boundary Element Method with other numerical methods.

CE 6102 Theory of Elasticity **Credit: 3**

Stress-strain relationship; Plane-stress and plane-strain; Stress functions; Two dimensional problems in rectangular and polar co-ordinates; Torsion; Energy principles; Stress and strain in three dimensions; General theorems; Three dimensional problems; Theories of problems; Theories of failure; Computer of Elasticity problem.

CE 6103 Theory of Plates **Credit: 3**

Rectangular plates with various edge conditions; Circular plates; Energy methods; Approximate methods; Orthotropic plates; Numerical methods in solution of plate problems; Non-linear analysis of plates.

CE 6104 Plastic Design of Structures **Credit: 3**

Review of fundamental concepts, Plastic hinges, collapse of beams and frames; Effects of axial load and shear forces; Investigation of plastic collapse loads; Upper and lower bounds; Plastic analysis and design of beams, frames and grillages; Plastic collapse of reinforced concrete and masonry structures; Elastic-plastic analysis; Repeated loading; Shakedown theorems; Minimum weight design; Numerical analysis; Design of multi-storied frames.

CE 6105 Elastic Stability of Structures **Credit: 3**

Stability of struts and beam-columns; Initial imperfections; Inelastic buckling; Stability functions; Stiffness matrix; Fixed end moments; Energy instability of plane frames; Critical load; Buckling modes; Failure load analysis; Torsional buckling under various conditions of end loads; Buckling by combined torsion and flexure. Lateral buckling of beams; Local buckling phenomenon; Buckling of thin plates and membrane shells; Buckling of built-up sections.

CE 6106 Finite Element Methods **Credit: 3**

Introduction to finite element concepts, Basic techniques; shape functions. Finite element formulations of various elastic problems ; Plane stress, Plane strain; Axisymmetric and three dimensional cases; Isoparametric elements; The elastic membrane; Thick shell and plate elements; Body of revolution with pressure and sinusoidal loading, Local loads from shape function routines; Bending of plates axisymmetric shells, shells- the semiloof beam and shell. Developing and implementing elements. Convergence the patch test. Solution techniques; Front and band solutions; Variational principles in finite element analysis.

CE 6107 Computer Methods in Civil Engineering **Credit: 3**

Advanced programming techniques related to Civil Engineering Problems; Program optimization; Computational pitfalls; Management of files and data bases; File structures; Direct access backing storage; Computational aspects of matrix algebra relaxation methods; Various reduction and elimination schemes; Eigenvalue problems, Storage and computation with large and space matrices; Numerical differentiation and integration, Interpolation and curve fitting; Linear and non-linear programming algorithms; Software packages; Computer graphics; Interactive analysis and design; Programming for civil engineering problems on microcomputers.

CE 6108 Advanced Design of Concrete Structures **Credit: 3**

Review of principles; Beams, slabs, and columns; Design of columns; long columns, two way slab systems, grids, waffle slabs, ribbed slab, deep beams, curved beams shear walls and building frames. Design for details of reinforced concrete members. Advanced problems in foundations of structures; Codes and specifications and their influence in design, an individual or group project to design a complete structural system. Prestressed concrete structures.

CE 6109 Analysis and Design of Tall Buildings **Credit: 3**

Structural forms of Tall Buildings- floor system, vertical load resisting system. Choice of system optimum design. Coupled shear walls- continuous medium, wide column analogy, and finite element solutions. Interaction of walls and frames- approximate methods, computer analysis, Masonry high-rise buildings. The future of high-rise building.

CE 6110 Finite Element Methods II **Credit: 3**

General sources of non-linearity in structures. Solution of nonlinear equations, incremental, Iterative, Newton-Rapson and Modified Newton-Rapson solution procedures; Geometric Nonlinearity- large displacement and structural instability, Lagrangian approach- both total and updated, Eularian approach, Material Nonlinearity- Materials Modelling. Yield criteria, plasticity, creep, elasto-plasticity, viscoplasticity modelling of reinforced concrete. Combined geometric and material nonlinearity. Finite element analysis of non-structural problems fluid flow, heat conduction, Electro-magnetic field analysis etc.

CE 6111 Structural Dynamics and Seismic Design of Structures **Credit: 3**

Fundamentals of structural dynamics. SDOF; Free vibration response; Response to harmonic, periodic, impulsive and general dynamic loading. MDOF, undamped free vibrations. Analysis of dynamic response. Beam: vibrations, random vibrations. Probability theory. Deterministic and nondeterministic analysis of earthquake response. Earthquake resistance design of buildings, bridges and dams.

CE 6112 Structural Brickwork **Credit: 3**

Properties of bricks and mortar; Strength compression element; Analysis and brickwork, Strength of brick masonry compression element; Analysis and design of unreinforced brickwork structures; Reinforced and prestressed brickwork structures; Composite action of brick masonry walls.

CE 6113 Advanced Theory and Design of Steel Structures **Credit: 3**

Tension members- Design criteria, Compression members- Buckling of column; Residual Stress; Column strength curves; AISC design formulae for working stress design; Buckling of plates; Design of column as affected by local buckling. Design of laterally supported beams; Shear on beams; Biaxial bending; Stresses due to torsions; Analogy between torsion and plane bending; Design for combined procedures for laterally unsupported beams. Beam column; AISC working stress design criteria for combined bending and axial load connections.

CE 6114 Advanced Concrete Technology **Credit: 3**

Properties of plane concrete; Physico-chemical aspects of behaviour of constituent materials, Cement aggregates and admixtures; Influence of material properties on stress distribution in structural members, Durability, permeability and porosity, physical and chemical deterioration. Mix design, manufacture, transportation and placing. Formworks; Field control and acceptance. Testing of destructive and non-destructive concrete for special purposes.

CE 6115 Theory and Design of Structural Concrete **Credit: 3**

Introduction to the limit state design concept; Ultimate limit state design of sections in bending, Shear, torsion and combination of axial load and bending, Comparison of different recommendations of different codes (viz. American,

British, Canadian etc), Evaluation of the impact of traditional concepts describing structural concrete behaviour on its analysis and design. Introduction to compressive field theory, strut and tie model and compressive force path concept. Design in compliance with these concepts. Prospects and problems of applying finite element method in the analysis and design of structural concrete.

MATH 6101 Advance Engineering Mathematics

Fourier Transform, Fourier Integral, Boundary value problems.
Calculus of variation: Elements of calculus variation, Euler-Lagrange equation, Hamilton's principle, Lagranges equation, Iso-perimetric problems.
Numerical Analysis: Solution of non-linear systems, Newton's method; Ordinary differential equation; Finite difference method, Shooting method. Solutions of partial difference equations.
Statistical Analysis: Sampling theory; Decision theory, Chi-square test, Analysis of Variance.

DIVISION OF WATER RESOURCES ENGINEERING

CE 6201 Advanced Fluid Mechanics I **Credit: 3**

Eulerian and Lagrangian coordinates; Reynold's transport theorem; Basic conservation laws; Continuity equation, Navier-Stokes equation; Energy equation, Two-dimensional potential flows; Complex potential and complex velocity, Circle theorem, Blasius integral formula and Cauchy integral formula; Three-dimensional potential flows; Velocity potential and Stoke's stream function and apparent mass.

CE 6202 Advanced Fluid Mechanics II **Credit: 3**

Dimensionless parameters in viscous flow; Non-dimensionalizing the basic equations and boundary conditions; Solutions of the Newtonian viscous flow equations; Coueette shear flows; Steady fully developed duct flows; Unsteady flow with moving boundaries; Laminar boundary layer equations; Similarity solutions for steady two-dimensional flow; Blasius solution for flat-plate flow; Falker-Skan wedge flows; One-parameter momentum integral solution of laminar boundary layer; Turbulent boundary layer equations; Eddy viscosity theories; Law of the wall; Law of the wake.

CE 6203 Open Channel Flow **Credit: 3**

Energy and momentum principles; Flow resistance; Boundary layer theory; Non-uniform flow computation; Channel controls; Channel transitions; Hydraulic jump and surges; Unsteady flow; Hydraulic method of flow routing; Overland flow; Mathematical models of open channel flow; Practical problems.

CE 6204 Advanced Hydrology **Credit: 3**

Precipitation- its temporal and spatial variability; Evapotranspiration; Runoff and its time-space distribution; Conceptual models; Hydraulics of overland flow; Flood in stream channel and flood flow estimation; Flood forecasting; Hydrology of urban, Agriculture and forest lands; Computer simulation of hydrologic techniques; Watershed models.

CE 6205 Statistical methods in Hydrology **Credit: 3**

Characteristics of hydrologic phenomena; Random phenomena and their distributions;
Various probability topics applied to hydrology; Empirical distributions of hydrologic variables; Parameters and statistics; Probability distribution functions; Estimation methods; Sampling theory; Testing hypothesis and goodness of fit; Correlation and regression; Auto-correlation and cross correlation; Analysis of variance; Time series, Spectral and cross spectral analysis; Stochastic models.

CE 6206 Advance Ground Water Hydraulics **Credit: 3**

Ground water movements; Storage, exploration and data. Basic principles and fundamental equations; Well hydraulics; Aquifer test and flow-net analysis; Transient flow; Unsaturated flow; Well design criteria; Construction, production tests and maintenance; Surface and sub-surface water relations; Ground water recharge and runoff; Ground water quality; Saline water intrusion; Subsidence and lateral movement of the land surface due to ground water pumping; Flow system analysis and models; Development and management of aquifers.

CE 6207 Flow through Porous Media **Credit: 3**

Mechanics of fluid movement in porous media; Seepage force and critical gradient; Anisotropy; Application of the Dupuit theory of unconfined flow; Conformal mapping by elementary functions; Confined flow; Relaxation method; Method of fragments; Flow through foundation structures; Seepage from canals and ditches.

CE 6208 Irrigation and Drainage Engineering **Credit: 3**

Determination of consumptive use; Soil-water-plant relations; Infiltration; Crop irrigation; Farm delivery and diversion requirements; Irrigation techniques; Irrigation efficiencies; Water management in irrigated lands; Salinity problems; Relation between irrigation and drainage; Surface and subsurface drains; Drainage system and their design; Small irrigation structures.

CE 6209 River Engineering **Credit: 3**

River hydraulics and morphology; Bedforms in alluvial channel; River channel patterns: Flood plain and their formations; Fluivial process in geomorphology; River training and bank protection works; Rivers in Bangladesh.

CE 6210 Sediment Transport **Credit: 3**

Sediment properties; Sources of sediment in rivers and canals; Types of loads: bed load, suspended load and total load; Critical review of the sediment transport theories and formulas; Sampling techniques; Modeling of sediment transport phenomena.

CE 6211 Hydro-Power Engineering **Credit: 3**

Introduction; Sources of energy; Estimation of water power potential; Types of hydropower plants; Intakes; Penstocks; Forebays; Tunnel; Power station; Wave and tidal power.

CE 6212 Hydraulic Structures **Credit: 3**

Design principles: Dams; Barrages; Channels and flumes; Spillways; Stilling Basins; Transitions and control Structures; Locks. Use of model in Hydraulic Design.

CE 6213 Photogrammetry in Water Resource **Credit: 3**

Principles of photogrammetry; Use of aerial photography; Land form analysis; Interpretation of drainage patterns, geomorphological and hydrological features, surface soils, vegetation and land use; Airphotos in planning and designing of water resource projects; Remote sensing.

CE 6214 Development of Water Resources Project **Credit: 3**

General principles of water resources development planning; Economics of water resources projects; Regional and social considerations; Different aspect of feasibility studies; Study of alternatives; Complete design of water resource project for a selected area.

CE 6215 Analysis of Water Resource System **Credit: 3**

Nature of water resources systems; Tools of systems analysis: Differential calculus methods, gradient search procedures, Linear programming, Dynamic programming. Systems analysis and mathematical modeling; Objective functions of water resources development; Short term operation of water resources system; River basin modeling.

CE 6216 Physical Modeling and Hydraulic Similitudes **Credit: 3**

Principles and illustration of dimensional analysis; Principles of the theory of similarity; Reynold's models; River and open channel models; Filtration models; Design of experiments; Materials and methods of construction; Equipment in models; Model calibration.

CE 6217 Mathematical Modeling **Credit: 3**

Introduction; Concept of a mathematical model, Types of model; Numerical modeling techniques; finite difference; characteristics finite element, consistency convergence, stability and accuracy of a numerical integration scheme. Hydrologic and hydrodynamic models: Data organization, Schematization and boundary conditions; calibration, validation and application of a model; Models of water resources systems elements.

CE 6218 Coastal Engineering **Credit: 3**

Introduction; Waves: theory and forecasting; Ports and marine structures: wharves; jetties, piers, bulkheads, dolphins, moorings, locks and shore protection works; Dredging; Uses of models.

CE 6219 Tidal and Estuarine Hydraulics **Credit: 3**

Estuarine behaviour: Hydrodynamics of estuaries; Mixing process; Tides and harmonic analysis; Modeling of tides; Saline water intrusion; Hydraulics of deltas; Pollution in estuaries; Control of estuaries, Estuarine problems in Bangladesh.

CE 6220 Computational River Morphology **Credit: 3**

Basic concepts; River Morphology; Morphological Computation. Principle of one dimensional morphological model; Mathematical formulation, schematized sediment transport, celerities of water-sediment movements. River bed response; steady, time dependent, Analytical models, Numerical models for fixed and mobile beds, Application of models in river problems; Flood mitigation and design of floodways. Extension of one dimensional model: Two dimensional vertical model.

DIVISION OF GEOTECHNICAL ENGINEERING

CE 6301 Soil Mechanics I
2 hours per week theory and 3 hour per week practical

Identifying characteristics of soils, clay minerals, clay-water relation, fabric, compression. One and three dimensional consolidation, swelling collapse and reological properties. Soil shear strength, concept of cohesion and internal friction. Failure theories; Bearing capacity equations and factors; Subsoil exploration programme, interpretation of topographic, geological and agricultural soil maps. Laboratory testing of soils and their interpretation for engineering purposes.

CE 6302 Soil Mechanics II **Credit: 3**

Soil porosity and moisture effects relative to effective stress principles, capillarity, permeability and frost action. Hydraulic facturing. Principles governing flow of water through soils. Soil seepage analysis for isotropic and anisotropies conditions. Numerical techniques for vertical and radial drainage. Description design procedure and usage of current site improvement techniques, vibrocompaction, blasting densification, lime treatment, drains and geotechnical fabrics.

CE 6303 Foundation Analysis Methods **Credit: 3**

Elastic foundations, loads on finite slabs, sub-grade coefficient, settlement on non-homogenous half space linearly elastic pile and soil, laterally loaded pile, soil foundation interaction for footing and mat designs. Analysis of simple pile and ground foundations. Exact and numerical solutions to above problems.

CE 6304 Earth Pressure and Retaining Structures **Credit: 3**

Fundamentals of lateral earth pressure and classical methods of analysis. Analysis of braced excavations, retaining walls and design of sheet piling system. Principles of cofferdam design; Bearing capacity theories related to shallow and deep foundations.

CE 6305 Earth Dams and Stability of Slopes **Credit: 3**

Seepage in composite sections. Methods of stability analysis, stability of slopes. Compaction. Measurement performance, construction and control of embankment.

CE 6306 Rock Mechanics **Credit: 3**

Classification and engineering properties of intact rocks, brittle fracture theory, Characterization and properties of rock, discontinuities criteria of rock failure. Engineering problems associated with construction in rocks; Stabilization, anchoring and rock bottling; Rock slope stability and reinforcement; Design of

underground opening and structures; Geotechnical aspects of open pit and underground mining; soft and hard rock. Material handling, waste disposal.

CE 6307 Soil Dynamics **Credit: 3**

Sources and types of dynamic loading. Vibration of elementary systems, Wave propagation in soils. Dynamic solid properties and methods of their determination, liquefaction, shear modulus and damping effects. Vibrations of foundations on elastic media, machine foundations, earthquake response, blast effects including nuclear weapon effects.

CE 6308 Advance Engineering Geology **Credit: 3**

Advanced physical geology concerning transported and residual soils. Erosion and deposition. Geomorphology. Study of the formation of delta. Engineering geology of soft clays; Engineering, properties of rocks. Geologic structures. Historical geology. Geology of Bengal Basin. Earthquake zones of Bangladesh. Geological considerations of engineering designs.

CE 6309 Reinforced Earth **Credit: 3**

Materials used in Reinforced Earth; Constitutive laws; Design parameters and testing techniques; conceptual performance of reinforced soil; Analysis, design and construction of reinforced earth retaining structures; Reinforced slopes; Design and construction of reinforced paved and unpaved road. Analysis, Design and construction of granular in situ stabilized columns; Soil nailing, root or micropiles. Random (non-oriented) fibre reinforced soil.

CE 6310 Constitutive Modelling in Soil Mechanics **Credit: 3**

Elasto-plastic modelling of soils; Model development process; Models for different types of soils; Monotonic cyclic and repetitive loading models; Modern approach of constructive modelling in soil mechanics; Thermodynamic approach of modelling. Application of soil models in Finite Element Method, Distinct Element Method and Finite Difference Method.

CE 6311 Advanced Soil Mechanics **Credit: 3**

Soil behavior; Critical state soil mechanics; Normalized strength; Stress space; Plastic behavior; Failure theories; Soil modeling techniques; Laboratory test results and applications.

CE 6312 Earthquake Engineering **Credit: 3**

Historical background; Plate tectonics; Various types of earthquakes and faulting; Wave types and their characteristics; Characteristics of seismometers and micrometer instruments; Characteristics of magnitude and intensity scales; Earthquake time histories; Fourier and response spectra; Historical seismicity and earthquake catalogues; Data acquisition, Sources, magnitude rescaling, application to hazard analysis; Site characterization: amplification and responses; Experimental simulation and shaking tables; Introduction to lifeline engineering; electricity, water, natural gas, telecommunication and transportation systems; Post earthquake damage survey; Mitigation strategies; Case studies of major earthquakes.

DIVISION OF ENVIRONMENTAL ENGINEERING

CE 6401 Theory of Water Treatment **Credit: 3**

Water and its impurities. Criteria of water quality; Physical, chemical and biological treatment processes. Desalinization and demineralization processes. Controls of aquatic growth. Control of taste and odour.

CE 6402 Theory of Sewage Treatment **Credit: 3**

Composition, properties and analysis of sewage. Biology and bio-chemistry of sewage treatment. Principles of physical, chemical and biological treatment processes. Tertiary treatment of effluents. Sludge digestion. Sludge dewatering and disposal.

CE 6403 Biology of Sewage and Polluted Waters **Credit: 3**

Important micro-organisms related to water and waste water engineering; Cell physiology; Introductory Biochemistry; Bacterial growth and disinfection kinetics; Enumerisation of bacterial population; Indicatory organisms and water borne pathogens; Sampling and bacteriological examination of water and waste water.

CE 6404 Environmental Sanitation. **Credit: 3**

Application of engineering principles to the control of communicable diseases; Vector control; Insecticides and bacteriocides; Collection and disposal of municipal refuse; Housing; Milk and food sanitation, Industrial and personal hygiens. Air pollution; Plumbing; Ventilation; air-conditioning; Hospital sanitation; Camp Sanitation.

CE 6405 Industrial Water and Waste Treatment **Credit: 3**

Requirements of water and various industries; Quality and treatment of industrial water; Characteristics and volume of industrial waste; Problems associated with industrial waste; Physical, chemical and biological methods of treatment; Industrial waste problems of major industries and their methods of treatment and disposal.

CE 6406 Municipal and Rural Sanitation **Credit: 3**

Transmission and control of communicable diseases; Importance of safe water supply and safe disposal of waste on sanitation; Principles of excreta disposal with and without water carriage; Individual water supply facilities and their sanitary protection; solid waste management; Municipal and rural sanitation facilities in Bangladesh; Public health organizations.

CE 6407 Water Pollution and Its Control **Credit: 3**

Sources of pollution; Effects on water; Basic theory of control devices; Pollution survey and control programs; Water pollution problems in Bangladesh.

CE 6408 Water Supply Engineering and Design **Credit: 3**

Development of design criteria for municipal and rural water sources; Intakes, pipe lines, distribution systems, storage facilities and water treatment systems; Ground water resources and well design.

CE 6409 Sewerage and Drainage Engineering Design **Credit: 3**

Design of collection system, pump house; Functional hydraulic and structural design and complete sewage treatment plant and drainage systems.

CE 6410 Environment Management **Credit: 3**

Environment and sustainable development; Global and regional approach to environmental management; Environmental implications of sectoral development; Infrastructure, water resources, industry, agriculture, transport and communication, energy, health and population, mineral resources, tourism, land use and urbanization; Environmental management at project level; Environmental resource management and conversation strategies; Environmental policy and legislation; Environmental Quality Standards (QES); Economics of Environmental Management.

CE 6411 Environment Impact Assessment (EIA) **Credit: 3**

Historical development; Definition, aims and objectives of Environmental Impact Assessment (EIA); Environmental Issues related to development projects; Project screening; Initial Environmental Examination (IEE); Impact Identification, prediction analysis and evaluation; EIA methodologies: Adhoc, Checklists, Matrices Network Simulation Modeling Workshops (SMW), Environmental Evaluation System (EES), Overlays, Geographical Information System (GIS) guidelines; Environmental Impact Statement (EIS) Impact mitigation plan; Environmental monitoring and post-development audits; Organization of EIA: Scope, Work plan, resource requirements and cost of EIA, TOR for EIA; EIA in developing countries; Case studies.

CE 6412 Surface Water Quality Modelling **Credit: 3**

Principal components of dissolved oxygen (DO) analysis; Sources and sink of DO kinetics DO analysis for water bodies, engineering control of DO; Basic mechanisms of eutrophication; Significance of N/P ratio; Sources and sinks of N and P, phutoplankton and nutrient interactions Phytoplankton-DO relationships;

Simplified river stream eutrophication analysis for phytoplankton and rooted aquatic plants; Objectives of modeling, applications; Mass lading rage estimations; point source, tributary and intermittent sources; Low flow estimates; Steady state stream equations; Estuarine hydrology; Distribution of water quality in rivers and estuaries; Dispersion coefficients, hydraulic transport processes, mathematical formulations, water quality parameters, solution techniques, multi-dimensional models; Physical and hydrologic characteristics of lakes, lakeside response to inputs; Finite segment steady state lake models; Model calibration and verification, sensitivity analysis parameter estimation, Case studies.

CE 6413 Environmental Fluid Dynamics **Credit: 3**

Governing laws of motion for a viscous fluid: Review of laminar and turbulent flows; Fician diffusion; Turbulent diffusion, Mass transport equation; Shear flow dispersion; Mixing in rivers and estuaries; Jets and buoyant jets; Reservoir dynamics; Pollutant movement in porous media; Computation of Environmental flows.

CE 6414 Aquatic Chemistry for Environmental Engineers **Credit: 3**

Review of some fundamentals of Chemistry; Approaches to equilibrium problem solving, numerical solution, graphical solution, the 'tableau method'; Natural weak acids and base; Alkalinity and p^H in natural waters; Buffer capacity; Dissolved carbonate equilibria (closed system), dissolution of CO_2-(open system), Solubility of solids, coexistence of phases in equilibrium; Metal ions and ligands in natural waters, aqueous complexes; Ion association among major aquatic constituent inorganic and organic complexation of trace elements; Redox equilibria and elctron activity, pe-p^H diagrams, redox conditions in natural waters; Aquatic particles.

DIVISION OF TRANSPORTATION ENGINEERING

CE 6501 Transportation Engineering **Credit: 3**

Historical development; System of transportation; Technical and operation characteristics of highways, railways, waterways, airway and pipe lines; transportation planning and development.

CE 6502 Geometric Design of Highways **Credit: 3**

Highway classification: Design controls and criteria; Traffic, vehicle characteristics, speed capacity; Elements of design; Sight distance, horizontal and vertical alignment; Cross-section elements; Road intersections, grade separation and interchanges; Highway drainage.

CE 6503 Highway Materials **Credit: 3**

Origin, production, specifications, properties and use of bituminous materials; Binder mixtures; Design and analysis of bituminous paving mixes; Field operations; Surface treatments, stabilization methods; Aggregates: base, sub-base and sub-grade; Cement concrete in pavement constructions.

CE 6504 Advanced Surveying **Credit: 3**

Triangulation: Classification and schemes. Instrument linear and angular measurements, field works errors and corrections, computations; Geometric leveling; Field astronomy; Motions of earth, and other stars, time, co-ordinate systems, errors and corrections; Hydrographic surveying: Determination of depth under water, measurement of discharge and stream current; Terrestrial and aerial photogrammetry; Instruments, field works, plotting of maps, analysis and interpretation of photographs stereophotogrammetry, remote and its application in civil engineering.

CE 6505 Structural Design of Pavements **Credit: 3**

Pavement types; wheel loads; stresses in pavements; Stresses in rigid pavements, pavement performance, evaluation of sub-grade and base support; Design theories and practices; Construction methods and maintenance; Pavement rehabilitation.

CE 6506 Traffic Engineering **Credit: 3**

Characteristics of vehicles and driver. Traffic stream, characteristics, Traffic control operation; Traffic surveys; Accidents and road safety; Parking, Roadway lighting, Traffic management and administration.

CE 6507 Railway Engineering **Credit: 3**

General requirements, permanent way, alignments, gradient and curves, point and crossings; Signaling and interlocking; Tunneling; Construction and maintenance.

CE 6508 Waterways **Credit: 3**

Historical development of navigation, navigational channels; Survey of waterways; Classification of waterways, Traffic vessels, ports and harbors, navigational aids; Maintenance of waterways.

CE 6509 Planning and Design of Airports **Credit: 3**

Growth and demand of air transport, airport site selection and configuration, geometric design of runways and taxiways; Terminal area; Capacity analysis; Lighting and marking, air traffic control systems; Structural design; Construction and maintenance of airport pavements, airport drainage.

CE 6510 Transportation Planning **Credit: 3**

Techniques and processes used in solving transportation problems, Relationship between trip generations and land use, collection and characteristics of base year data formulation of mathematical models to simulate existing travel patterns; Forecasting procedures and evaluation of transportation systems.

CE 6511 Transportation Engineering Economics **Credit: 3**

Introduction to basic economic theories; Principles and methodologies appropriate to Transportation Engineering; Identification and measurement of transportation costs and benefits; Road user charges and principles of road pricing; Evaluation of transportation proposals in terms of their economic, social and environmental consequences; Techniques of cost benefit analysis; Selected case studies-application of economic to one or more current issues in transportation policy and planning.

CE 6512 Traffic Simulation **Credit: 3**

Introduction to simulation techniques; Review of Monte Carlo simulation; Macroscopic simulation; Deterministic and stochastic simulation; Simulation in traffic engineering; Review of traffic simulation models; Lane-based and non-lane-based mixed traffic simulation; Simulation system components; Introduction to statistical distributions, sampling techniques, simulation warm up and update procedures; Development of traffic simulation model; Logical aspects of modeling traffic flow components, elements of systems analysis and synthesis; Model verification refinements and parameter estimation; Estimation calibration and validation; Application of simulation models.

CE 6513 GIS and Remote Sensing in Transportation **Credit: 3**

Concepts of Geographic Information Systems (GIS): Definition, data structure, data processing and management, spatial analysis; GIS software; Basic principles of remote sensing (RS) and global positioning systems (GPS): Definition, data acquisition, spectral characteristics of land cover, multi-spectral analysis, image interpretation, geometric corrections, classification techniques; Integration of RS and GPS with GIS; GIS applications in the field of transportation planning and traffic engineering; Digitised mapping of land use and transport network; Transport infrastructure development and management; Analysis and predication of impacts, strategy planning; Monitoring and evaluation of transport systems and environment route selection; Traffic management and accident analysis; Public transport information systems; Integration of GIS packages with transport modelling software.