

جامعة
الملك سعود
King Saud University



GRADUATE STUDENT HANDBOOK

January 2021

DEPARTMENT OF CIVIL ENGINEERING
COLLEGE OF ENGINEERING
KING SAUD UNIVERSITY



Handbook
For
Civil Engineering Graduate Students

Department of Civil Engineering
College of Engineering
King Saud University

January 2021

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PART A. DEPARTMENT OF CIVIL ENGINEERING

1. About the Department

The Civil Engineering Department is one of the earliest departments established in the Kingdom's universities. The department was established in 1382H (1962). The department makes an indispensable contribution to the development and advancement of the Kingdom. Department graduates play a vital role in all development plans of the country. They are heavily involved in construction, transportation, water, environment protection, project management, and soil treatment engineering projects. The department is continuously updating the curricula of undergraduate and graduate programs to keep pace with the national and international developments.

Civil engineering is one of the main pillars of the advancement of any country through establishing the infrastructure projects necessary to the welfare of human being. Since its establishment, the civil engineering department has effectively contributed to the rapid development of the Kingdom. The graduates hold key positions in all governmental and private sectors.

The department is fully equipped with high-quality laboratories and workshops that cover all aspects of civil engineering. These laboratories and workshops are subjected to continuous updating to keep pace with the latest technology requirements.

The diverse areas of specialty associated with civil engineering provide the graduates with excellent job opportunities both in the governmental and in the private sectors.

Contact Information

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2. Graduate Program in Civil Engineering

2.1. Vision

To be a globally recognized graduate program in civil engineering education, innovation and technological advancement in building the knowledge economy.

2.2. Mission

Provide a distinguished high-quality graduate education program to promote Civil Engineering applications and produce specialized Civil Engineers to attain a sustainable excellence in Civil Engineering industry during the 21st century, and to serve the society through involvement in knowledge sharing outreach, innovative research, developing new technologies, continuing education and professional activities.

2.3. Program Objectives

Graduates of MSc program are prepared to:

- Implement civil engineering specialized knowledge to create high-quality systems and attain the excellence in civil engineering infrastructure
- Improve their technical awareness and leadership skills through life-long learning, implementing recent technologies and professional development
- Contribute time, knowledge and skills to lead the profession and serve the community, and the nation beyond job responsibilities.

2.4. Program Outcomes

The Program prepares the graduates to be able to:

A. Knowledge

- Recognize advanced engineering knowledge, concepts and techniques to identify, interpret and analyze complex and real-life engineering problems (K1).

B. Skills

- Provide solution for complex and real-life engineering problems through critical thinking and using modern engineering tools and identify its impact on social and ethical issues (S1).
- Investigate scientific research problems independently or through a team work using critical thinking, appropriate techniques, advanced tools, and management principles (S2).

C. Competence

- Criticize and discuss scientific research reports /papers related to Civil Engineering issues with high level of ethics and proficiency, independently, or as a team work (C1).
- Design novel advanced Civil Engineering systems and evaluate its performance and effectiveness for engineering practice and its impact on society (C2).

3. Civil Engineering Department Laboratories

Laboratories play an essential role in serving academic and research programs for students and faculty members of the Civil Engineering Department. In addition, these laboratories conduct research and experimental tests for several public and private sectors. The department has many laboratories in all fields of Civil Engineering, which includes:

- Structural Engineering Laboratories
- Hydraulics and Fluid Mechanics Laboratories
- Environmental Engineering Laboratories
- Transportation Engineering Laboratory
- Soil Mechanics & Geotechnical Engineering Laboratories
- Surveying Engineering Laboratories

The laboratories hold modern and technically advanced instruments, for more information about the equipment variable at the Civil Engineering Department, please visit the following website. <https://engineering.ksu.edu.sa/en/Laboratories>

4. Research Chairs and Center of Excellence

The Department has established different research chairs and center of excellence. More than 30 staff members are working in these chairs and centers as professors, research fellows, research assistants, lab engineers and lab technicians. A brief description of research chairs and center of excellence is given below.

4.1. Chair of Research and Studies in Rehabilitation and Upgrading of Structures:

The chair was established in 2008. Undoubtedly, the establishment of Sheikh Mohammed Chair (SMC) would be an essential element for the completion of the system that will work through studies and researches on modern techniques to rehabilitate structures suffering from the deterioration or needed to be strengthened to be able to bear that loads which were not taken into account at the design stage such as seismic and/or wind forces as per the Saudi Building Code.

4.2. Eng. Abdullah Bogshan Chair in Expansive Soils.

Eng. Abdullah Bogshan Research was established in 2008, Promoting a scientific environment that fosters innovation and undertaking of a cutting-edge research in various aspects related to expansive soils including swelling behavior, treatment and foundation systems. The main object is implementing and utilizing research results for the benefits of building industry in the Kingdom capitalizing on the university resources and facilities.

4.3. Center of Excellence for Concrete Research & Testing

Center of Excellence for Concrete Research and Testing (CoE-CRT) was established in May 2008. The main focus of CoE-CRT is on continuous improvements of the quality of concrete production and construction, research and development, education and training and updating of codes and specifications. The Center will support long-term concrete research and development leading to potential breakthroughs in concrete materials development and utilization. The Center will support, promote, and develop the research capabilities and professional activities and offer assistance to cement, concrete and construction industries, regulatory agencies such as Saudi Building Code National Committee (SBCNC), Saudi Arabian Standards Organization (SASO) and other public and private sectors which are in need for the Center's expertise, facilities and laboratories.

5. Graduate Studies Coordinator

Tasks and Responsibilities:

- Receiving the list of applicants from the Deanship of Graduate Studies and distributing this list to the appropriate specialized groups within the department
- Reviewing short-listed applicants to ensure the selection is in accordance with the admission requirements of the department and providing a report to the chair.
- Submitting the selected applicants to the Deanship of Graduate Studies through their online system
- Providing the orientation to the new students
- Monitoring the academic guidance and counseling to the students
- Monitoring thesis proposals and thesis defense of research students
- Maintaining the record of the students and analyzing the academic progress regularly
- Tracking the progress of students to ensure the time-bound completion of the MSc program

6. Graduate Studies Committee

The Graduate Studies Committee assists the department council in ensuring the maintaining of the highest standards and quality in teaching, learning, research, and scholarship. It advises the department council about policy and procedures relating to postgraduate study at the University. It determines postgraduate matters, including the approval of new and amended

courses, according to the King Saud University policy and the National Commission for Academic Accreditation and Assessment requirement for graduate studies. GDC consist of graduate convener and Graduate coordinator and faculty members from specialized groups within the department.

Tasks and Responsibilities:

- Develop, maintain, and monitor policy and procedures for the operation of the Department's graduate program, consistent with Graduate Studies Deanship rules.
- Prepare, publish, and distribute documents describing the Department and describing policies, rules and procedures for Department programs, including maintaining and issuing M.S. and Ph.D. brochures.
- Handle administrative tasks necessary to keep the graduate program operating in accordance with Departmental and University rules and regulations.
- Establishing new non-thesis MSc program in the department
- Developing criteria for new applicants and maintaining regulations of the department for the selection process
- Develop and maintain procedures to estimate graduate
- Provide assistance, as required, to the curriculum committee.
- Updating/revising the criteria for new applicants and maintaining the regulations of the department for the selection process.
- Providing the assistance to graduate studies convener and coordinator when needed.
- Following up with Accreditation committee for NCAAA process
- Approve applications to graduate for M.S. and Ph.D. students.

PART B. ACADEMIC PROGRAMS, REQUIREMENTS, AND POLICY

1. Introduction to the M.Sc. and Ph.D. Programs

On the recommendation of the Graduate Studies Deanship Council, the University Council set detailed criteria for endorsing graduate programs. The following measures should be taken into account:

- a. The initiating department should have a sufficient number of faculty members (professors and associate professors) specialized in the program area, in addition to research facilities to ensure the success of the program in terms of teaching, supervision, and research.
- b. The department should have gained appropriate experience on the undergraduate level if proposing a master program and so on the master level if the proposed program is a doctorate one.
- c. Expectancy of students' number to enroll in the program should be sufficient to ensure proper continuity.

Taking into account measures enforced in Item VII of the Unified Law Organizing the Graduate Studies in Saudi Universities, the initiating department submits a detailed program draft to its College Council, elucidating the following:

- a. Program's objectives and the extent of need for it in the Saudi society.
- b. Nature of the program in terms of academic and professional focus and scientific methodology.
- c. The importance of the program and the justifications for initiating it, in light of its availability inside the university or outside in other universities in the Kingdom.
- d. Available and required facilities in the department to allow proper academic and professional running of program, and identifying, in particular, main research areas of the department.

- e. Ratio of faculty members' stability in the department over the past five years.
- f. Curriculum Vitae of faculty members in the department and of those associated with the program at the university.

The Graduate Studies Deanship Council examines program draft, coordinates with extant programs, if any, to preclude duplication, and, on being satisfied, recommends program to the University Council for endorsement.

The University Council issues resolution on course amendments, programs' requirements, and admission conditions on the recommendation of the Graduate Studies Deanship Council as coordinated with relevant departments. Joint graduate programs between two departments (or more) and two colleges (or more) can be established at the university according to rules set by the University Council on the recommendation of the Graduate Studies Deanship Council in coordination with relevant departments.

The study for a master degree is possible through one of the two following modes:

- a. Course/Thesis mode: of minimally twenty-four hours of graduate courses plus a thesis.
- b. Course only mode: in some disciplines of professional nature, provided that study units are minimally forty-two hours of graduate courses inclusive of three units' research project.

The study plan for a master degree should preferably include graduate courses related to specialization from other departments whenever possible.

The study for a doctorate degree is possible through one of the two following modes:

- a. Course/Thesis mode: of minimally thirty hours of graduate, post-master courses plus a thesis.
- b. Course/ Dissertation mode: of minimally twelve hours of graduate courses of directed studies, symposia and seminars, as called for by student's academic interests and specific specializations, plus a dissertation.

2. Degrees requirements

2.1. Credit hours

The number of study units covered by the graduate student at the degree-granting university should be minimally seventy percent of program required units; the student should also fully prepare the thesis/dissertation under the supervision of that university. The student shall only graduate on having completed all program requirements, provisionally with a minimum accumulative grade average of “Very Good”.

2.2. Transfer Credit

Transfer of students to the university from another accredited university is possible upon the recommendation of both Department and College Councils and the Graduate Studies Deanship Council, taking into account the following regulations:

- a. Local conditions for admission should apply to transfer students, in addition to any further conditions relevant departments may deem necessary.
- b. The student should not have been dismissed (regardless of reasons) from the transferring university.
- c. Courses studied earlier may be transferred, according to the following regulations:
 - i. Courses should not have been completed more than six semesters ago.
 - ii. Course content should be directly related to the program transferred to.
 - iii. Courses transferred should not exceed in ratio thirty percent of the courses of the program transferred to.
 - iv. Student’s grade in transferred courses should minimally be “Very Good.”
 - v. Courses transferred are not included in the computation of the new cumulative average.
 - vi. Transfer of courses should be based on the recommendation of the Department Council and the approval of both College and Graduate Studies Deanship Councils.

The student may transfer from one major to another in the university on the recommendation of respective department and college councils and approval of Graduate Studies Deanship Council. The following regulations should be taken into account:

- a. Current conditions for admission should apply to transfer students in addition to any further conditions relevant department may deem necessary.
- b. Courses already studied at the university may be transferred if related departments find them corresponding to their programs; they will be included in computing students' cumulative average.
- c. Student's registration in a previous department should not for any reason have been repealed.
- d. Time spent in the program transferred from shall be counted within the maximum time limit for obtaining the degree.
- e. Transfer from one program to another is allowed only once during the period set for obtaining the degree.

2.3. Time Limits

Departments Councils may stipulate that students applying for a master or a doctorate program ought to complete a number of additional courses from the previous level. **The time limit** allotted to such courses should not exceed three semesters. The following conditions should also be taken into account:

- a. A student should pass each additional course at first sitting with a minimum grade of "Good."
- b. The cumulative grade average of the total number of additional courses should be a minimum of "Very Good."
- c. Registration in the graduate program becomes possible after proper completion of additional courses; Department Councils may permit registration in some graduate courses hand in hand with one or two of the additional courses towards the end of this preliminary stage.
- d. Time spent in additional courses is not counted within the time limit for obtaining the degree.

- e. The grades of the additional courses are not included in the computation of the cumulative grade average of the graduate courses.

The academic year branches off into two main semesters. The duration of each is minimally fifteen weeks (exclusive of registration and examinations periods). A summer session of minimally eight weeks, doubling the time span allotted to each course, is also available.

- a. The duration for obtaining a master degree is a minimum of four semesters and a maximum of eight; summer sessions are not counted within this period.
- b. The duration for obtaining a doctorate degree is a minimum of six semesters and a maximum of ten; summer sessions are not counted within this period.

The maximum period for obtaining a degree starts with registration in graduate courses until the date of submission of the thesis (or any other program requirements) together with a report by student's supervisor to the Head of the Department.

2.4. Responsible Scholarship & Research Skills

The researcher should briefly point out the thesis subject and its significance in theory and practice, and reasons for choosing it in view of the research problem and data available. The researcher should briefly review the most significant previous studies relevant to the research subject, objectives and methods, identifying previous studies and their findings. The researcher should present a clear statement of the research topic and its objectives.

The researcher should explain the aims of the research to be articulated in the form of assumptions the study seeks to test or questions it tries to answer, the method the researcher intends to follow in order to fulfill the aim of the research, and tools used, including research methodology:

- a. Identifying research methodology according to need (comparative, descriptive, analytical, quantitative, etc.).
- b. Giving details of methodological procedures employed in collecting information and library data (preliminary and secondary references) as well as field, laboratory data, etc. and methods of analysis.

2.5. Admission

The University Council determines the annual number of students that will be admitted into graduate programs. Departments and colleges councils and recommended by will propose the number of students and the Graduate Studies Deanship Council will approve it. Admission into graduate programs requires the following:

- a. Applicant should be a Saudi citizen or, if non-Saudi, have an official grant for graduate studies.
- b. Applicant should be a university degree holder from a Saudi or an accredited university.
- c. Applicant should be of good behavior, fair reputation and medically fit.
- d. Applicant should submit two letters of recommendations from professors who taught him.
- e. Applicant, if employed, should provide an employer's consent for studying. In cases that require it, consent submission can wait till registration period.
- f. Applicant for a doctorate program should enroll as a full-time student.

Each university council can stipulate any additional conditions it deems necessary. The Diploma admission requirement is a minimum grade average of "good" in the bachelor degree. Admission requirement for a master program is a minimum grade average of "Very Good" in the bachelor degree. However, the Graduate Studies Deanship Council can admit a student with a "high good" average, provided that student has scored a minimum of "Very Good" in specialization courses in the bachelor degree.

The Graduate Studies Deanship Council can stipulate, on the recommendation of Departments Councils and support of Colleges Councils, any additional conditions it deems necessary for admission. Admission requirement for the doctorate program is a minimum grade average of "Very Good" in the master degree, if awarded by a university that uses such a grading system. The Graduate Studies Deanship Council can stipulate, on the recommendation of Departments Councils and support of Colleges Councils, any additional conditions it deems necessary for admission.

A student may be admitted into a master or doctorate program in a field different from his specialization. Such admission requires the recommendation of both Department and College Councils and the approval of the Graduate Studies Deanship Council. The Deanship of Graduate Studies admits students into graduate programs and registers them in coordination with the Deanship of Admission and Registration. Admission procedures are as follows:

- a. Applicants should apply and submit full documents to the Deanship of Graduate Studies the first semester of the academic year preceding the one they would wish to enroll in.
- b. The Deanship of Graduate Studies forwards documents to the respective departments.
- c. Department Councils recommend students for admission, and documents of applicants are returned to the Deanship of Graduate Studies in two weeks from the date of recommendation.
- d. The Graduate Studies Deanship Council issues decisions of students' admission.
- e. The Deanship of Graduate Studies forwards all documents to the Deanship of Admission and Registration (keeping copies in the meanwhile) and provides respective departments with lists of admitted students at least two weeks before the registration period.

❖ MSc Programs Admission Requirements

The following are the minimum basic requirements for potential candidates to be considered for MSc Programs in the Department of Civil Engineering:

- a. Bachelor degree in Civil Engineering from a recognized institution with very good overall grade (GPA of 3.75/5 or 75% of marks or its equivalent). Official transcripts and degree certificates are required for the final admission.
- b. Completion of English proficiency; TOEFL with a minimum score of 53 (Internet Base Test) or IELTS minimum score of 5.5. The score must be sent directly to the Deanship of Graduate Studies (KSU code for TOEFL is 7498 and for IELTS code is 147080).

- c. Two recommendation letters from the faculty who taught the applicant at the university level courses.

❖ PhD Programs Admission Requirements

The following are the minimum basic requirements for potential candidates to be considered for PhD Programs in the Department of Civil Engineering:

- a. Master's degree in a relevant field from a recognized institution with very good overall grade (4.25/5, 80% or its equivalent). Official transcripts and degree certificates are required for the final admission.
- b. Bachelor degree in Civil Engineering from a recognized institution with very good overall grade (GPA of 3.75/5 or 75% of marks or its equivalent).
- c. Completion of English proficiency; TOEFL with a minimum score of 61 (Internet Base Test) or IELTS minimum score of 6.0. The score must be sent directly to the Deanship of Graduate Studies (KSU code for TOEFL is 7498 and for IELTS code is 147080).
- d. Graduate Record Examination (GRE) minimum score required is 150 (Quantitative) or its equivalent. The score must be sent directly to the Deanship of Graduate Studies (KSU code is 2101).
- e. Two recommendation letters from the faculty who taught the applicant at the university level courses.

3. Comprehensive Exam

3.1. Comprehensive Examination for PhD Students

Exam tests the depth and comprehensiveness of students' understanding of the main topics of their specialization (and sub-specialization if any).

The purpose of the exam is to evaluate the doctoral candidate's overall knowledge of relevant subject matter, to challenge the candidate's ability to critically evaluate the literature, and to assess their ability to effectively communicate and discuss scientific concepts both in written and oral formats. The skills thereby attained by students in the preparation for and performance of the Comprehensive Examination mark an important level of accomplishment in their scientific training.

The ability to consolidate knowledge and prepare critical summaries in a timely manner is an essential skill for the successful preparation of manuscripts, proposals, and reports, which graduate students, as new scientists, will encounter increasingly during their careers. In addition, successful completion of the exam ensures that the candidate possesses the background knowledge and reasoning skills necessary for the doctoral thesis defense.

Preparation for the Comprehensive Examination Candidates are expected to exhibit a general knowledge of their specialization in civil engineering, advanced knowledge in their general discipline (as defined by the candidate's examination committee), and detailed knowledge on their major discipline. Candidates are strongly advised to begin reviewing their general and advanced knowledge in preparation for the Comprehensive Examination immediately upon entering the doctoral program. The comprehensive exam should take place after completion of all required coursework. The design course CE 695 for comprehensive exam should be registered by the beginning of the semester.

3.2. Examination Committee

The Examination Committee will consist of at least three faculty members and one additional member to be chosen by the Graduate committee to be responsible for ensuring that the departmental comprehensive examination process is uniformly applied to all candidates.

- a. Related department council sets up a committee of at least three teaching staff members (professors and associate professors) with competence in student's main specialization or sub-specialization (where applicable)..
- b. The committee may seek help from other specialized members of the department.
- c. The committee shall be responsible for preparing, evaluating and determining the outcome of the exam.
- d. In cases where a program includes specialization or sub-specialization outside the department, a specialist from the relevant department should participate in exam committee.
- e. The committee for both written and oral exam should be the same.

3.3. Written Comprehensive Examination

- a. Students sit for the exam during the semester following completion of course work. Sitting for the exam can be postponed, on the approval of the department council, for one semester.
- b. The duration of the exam is minimally five hours in main specialization and three for each sub-specialization (where applicable). Dividing exam writing into two separate periods is highly recommended.
- c. In the event of failing the exam (or part of it) a student may re-sit for the failed part the following semester.
- d. Failing the exam (or part of it) a second time would cause the student to be terminated from the program.

The Examination Committee will meet after performing the committee officially by Chairman of civil engineering which almost 5 weeks after registration of the comprehensive exam course. Comprehensive Exam committee should set the exam questions prior the end of semester by 6 week minimum. These questions should deal with topics that are related to the student's own research area.

In many cases the topics will be designed to strengthen the candidate's knowledge in an area of weakness subjects. Essay topics are generally fairly broad, covering an important area in the

general discipline. Candidates are encouraged to consult with Examination Committee members regarding the form, content, and expectations of the written papers.

To facilitate this process, the identity of primary and secondary readers for each topic will be indicated to the candidate at the time that the topics are received. Candidates are also encouraged to refer to Comprehensive Examination essays done by former students. It is also useful to consult graduate students who have recently passed the Comprehensive Examination for advice.

3.4. Oral Comprehensive Examination

- a. The candidate will be examined orally by the Examination Committee after passing all parts of the written one, on a date determined by the committee.
- b. Oral exam duration for main and sub specialization (where applicable) is a minimum of two hours.
- c. In the event of failing this exam, a student shall be given another chance the following semester; a second failing would terminate the student from the program.

The examination will stress lateral thinking and factual knowledge related to the essay topics, the candidate's discipline, and general topics in civil engineering. The candidate's level of knowledge in their general discipline will be assessed by all members of the Examination Committee during the course of questioning. Candidates are advised to expect some questions relating to the examination topic for which the candidate chose not to provide a written essay.

In addition, the candidate should be prepared to answer questions relating to the candidate's field of discipline, and general topic. When answering questions from the Examination Committee candidates are advised to begin with the basics and then develop the answer to a more advanced level of knowledge. Examination Committee members may interrupt an answer if the candidate clearly has a detailed knowledge of the subject matter, since one purpose of the examination is to identify apparent deficiencies in the candidate's knowledge.

3.5. Dates of Exams

Both parts of the comprehensive exam (written and oral) are held once in the semester between the fourth and the tenth week; a minimum of two weeks time should separate the two.

4. Supervisor Section (Committee)

Each graduate student should, at start of enrolment in a program, have an academic guide to direct the study, assist in selecting a thesis topic and preparing a research plan according to University Council regulations initiated by Deanship of Graduate Studies. The student should submit (where applicable) a thesis proposal to the department.

The procedure is permissible after meeting all admission requirements and completing at least fifty percent of the course work with a cumulative average of at least “Very Good.” Once it recommends a proposal for approval, the Department Council should name a supervisor (and an Assistant Supervisor where applicable) of the thesis.

In cases that require a Supervisory Committee, the council should name committee members and specify a Chairman. College Council’s approval of all previous procedures is necessary before ultimate approval by Graduate Studies Deanship Council.

Masters theses subjects should be characterized by newness and originality; doctorate dissertations by originality, innovation and active contribution to the development of knowledge in the student’s discipline. Masters theses and doctorate dissertations should be written in English.

It is permissible to have some written in a different language in certain disciplines on the recommendation of respective Department and College Councils, the Graduate Studies Deanship Council and the decision of the University Council, provided that an abstract in Arabic is supplemented to the thesis.

4.1. Supervisors Selection

The thesis should be supervised by Professors and Associate Professors of the University faculty members. Assistant Professor, holding this rank for two years, may supervise masters’

theses only on having published (or obtained acceptance for publication of) two research items (in student's area of specialization) in a refereed academic journal.

Thesis and dissertations may be supervised by outstanding and highly competent experts in the field of scientific research who are not necessarily teaching faculty members of the University, on the recommendation of respective Department and College Councils, the Graduate Studies Deanship Council and the decision of the University Council. Recommended experts should meet the following conditions:

A. Masters Theses

- a) Have a doctorate degree.
- b) Have held the degree for at least three years.
- c) Have at least three items of research (in the student's area of specialization) published or accepted for publication in a refereed academic journal.

B. Doctorate Dissertations

- a) Have a doctorate degree.
- b) Have held the degree for at least five years
- c) Have at least six of research items (in student's area of specialization) published or accepted for publication in a refereed academic journal.

Faculty members of other departments may assist in the supervision, depending on the nature of the thesis, provided that the main supervisor comes from the student's department.

Supervisors (individuals or joint) can supervise a maximum of four theses at a time; the number of the thesis may in urgent cases (on the recommendation of relevant Department Council and the consent of both College and Graduate Studies Deanship Councils) be increased to five. Thesis supervision counts as one credit hour each in faculty members teaching loads (when individuals or main).

If the supervisor cannot continue, or his service in the University comes to the end, a substitute is proposed by the Department Council, approved by College Council and authorized by Graduate Studies Deanship Council. The contribution of the former supervisor should be accredited in the thesis.

The supervisor should, at the end of each semester, submit a detailed report to Head of Department on the student's progress in the study, a copy of the report should be sent to the Dean of Graduate Studies. Once the student's completion of the thesis, the supervisor should submit a Report to the Head of the Department to announce this and declare thesis suitability for discussion. The act comes as a prelude to the rest of the procedures specified by the Graduate Studies Deanship Council, namely:

- a. The College Council proposes (upon the suggestion of Department Council) the thesis Judging Panel in accord with Items (LV), (LVI) of the Unified Law Organizing the Graduate Studies in Saudi Universities.
- b. Names of panel members should be forwarded to the Graduate Studies Deanship Council, for approval, within a period not exceeding one month from the date of the College Council's decision.
- c. Following the Graduate Studies Deanship Council's approval of panel members, the Head of relevant Department forwards thesis to members and sets a date for defense.
- d. Thesis defense should be conducted in public, but might be done, at the discretion of the department, in private when necessary; the verdict is immediately pronounced after the defense.
- e. In case the thesis proves entirely unsuitable for defense, the Deanship of Graduate Studies must be notified to terminate the student's enrolment, in compliance with Clause (9) of Item (XXVI) of the Unified Law Organizing the Graduate Studies in Saudi Universities.
- f. The time limit between the Graduate Studies Deanship Council's approval of the Judging Panel and the date of the defense should not exceed four months; public holidays do not count within this period.

If the student is proven not to be serious in study or neglectful of academic obligations, the student then, based on a report by his supervisor, shall be warned in a letter from the department. If the student is warned twice but does not rectify the situation, the Graduate Studies Deanship Council, on the commendation of the Department Council, may terminate his enrolment in the program.

The time limit between approval of thesis proposal by the Deanship of Graduate Studies and submitting a completed thesis to the department should be minimally two semesters for a master thesis and four for a doctorate.

4.2. Defense Committee

Thesis Judging Panel is set up by the Graduate Studies Deanship Council on the recommendation of respective Department and College Councils. The following is required in the judging panel for a master thesis:

- a. Its members should be odd in number, and the supervisor should be chairing it.
- b. The minimal number of the panel is three teaching faculty members; the supervisor and assistant supervisor (if any) should never form a majority in the committee.
- c. Conditions for thesis supervisors do apply to the judging panel members.
- d. A professor, or an associate professor, should at least be among committee members.
- e. Decisions are made through consensus of, at least, two-thirds of its members.

The following is required in a judging panel for a doctorate dissertation:

- a. Its members should be odd in number, minimally three, and the supervisor should be chairing it.
- b. Its membership should be exclusive to professors and associate professors; the supervisor and assistant supervisor (if any) should never form a majority in the committee.
- c. One of the committee members, at least, should be a full professor.
- d. One of the committee members, at least, should come from outside the university.
- e. Decisions are made through consensus of, at least, two-thirds of its members.

In the event of thesis supervisor's inability to participate in the judging panel (due to death, retirement or a long-term task assumed outside the country), the department proposes a substitute to be approved by the College Council and authorized by the Graduate Studies Deanship Council.

The Judging Panel issues a report to be signed by all members and processed to Head of Department within one week from the date of the defense. The report should include one of the following recommendations:

- a. Accepting the thesis and recommending degree awarding.
- b. Accepting the thesis with some amendments, but no further defense. A member of the panel shall be authorized to recommend degree awarding on ascertaining that amendments are made. Amendments should be completed within a period not exceeding three months from date of defense. However, the University Council may exceptionally permit time extension on the recommendation of the Graduate Studies Deanship Council and the judging panel report.
- c. Require rectifying of deficiencies in thesis and another defense within a time limit (not exceeding in length one year from the first) to be specified by the Graduate Studies Deanship Council on the recommendation of relevant Department Council.
- d. Not accepting the thesis.

Each member of the judging panel has the right to present different views or reservations in a detailed report to both Head of Department and Dean of Graduate Studies within a time limit not exceeding two weeks from the date of the thesis defense. Head of related Department forwards panel's report to the Dean of Graduate Studies within a time limit not exceeding three weeks from the date of the thesis defense. The Dean of Graduate Studies forwards recommendations of degree awarding to the University Council for approval.

A master degree supervisor from outside the university shall be paid a single reward of five thousand Riyals, and a doctoral degree supervisor from outside the university shall be paid a single reward of seven thousand Riyals.

A committee member participating in the judging panel of a master thesis or doctorate dissertation is paid a single reward of one thousand Riyals (on being a teaching faculty in the same university to which thesis is submitted). University personnel (non-teaching member) and participant from outside the university are paid a single reward of one thousand five hundred Riyals for a doctoral dissertation and one thousand Riyals for the master. Panel members from outside the Kingdom receive two thousand five hundred Riyals.

Panel members from outside the city where thesis is examined (whether from inside or outside the Kingdom) are paid (in addition to the aforementioned reward) a two-way flight ticket, adequate accommodation (up to two nights), and subsistence allowance; a flight ticket is also paid for the person escorting the panel member if blind.

5. Policies and Rules

5.1. Duration of study

- a. The Maximum duration of study is 4 years for master students and five years for PhD students.
- b. Student should register a minimum of two courses per semester (min. 6 hr)
- c. The supervisor should send a report every semester about the status and the progress of his student.

5.2. Drop and Postponement

A. Admission Postponement

Department Councils, College Deans and the Dean of Graduate Studies may approve postponement of students' admission into a program for a maximum period of two semesters; the period will not be counted within the time limit for obtaining the degree.

B. Registration Postponement

Department Councils, College Deans and the Dean of Graduate Studies may approve postponement of students' registration under the following condition:

- a) The student must have successfully completed at least one semester in the program or covered a substantial part of the thesis.
- b) The time limit of postponement should not exceed two semesters (one year of study).
- c) Requests for postponement should be submitted at least two weeks before the start of the semester.

- d) Postponement Period will not be counted within the maximum time limit for obtaining the degree.
- e) Defer the application, applicant should have a reasonable excuse to defer or change the start date of study (Like visa issue, family issue....)

C. Drop of Courses

A drop of courses will not be entertained after the announced registration dates are over. Some consideration could be given to the students within one week of the beginning of classes to drop the course.

A student registered in a program will not be able to add or drop a course on the second week of the program in the University unless he has obtained the permission from the Head of Department responsible for the program.

If a student decides to drop a course at the beginning of the second week, it will be called a withdraw instead of drop courses. The maximum number of courses that student can withdraw during his program will be only two courses.

The maximum number of courses that student can withdraw during the whole program period will be only two courses.

D. Drop of a Semester

The student may (after registering) drop all courses of the semester according to the following regulations:

- a) Submit a request to the Head of the Department at least five weeks before the final exam period.
- b) The student should receive approval from the Department Council and Deans of both College and Graduate Studies.
- c) Semester should not be part of the additional opportunity period.
- d) Semester counts as part of postponement period.
- e) The student shall be considered as having failed all courses he registered in (in the dropped semester) if not abiding by the above rules of dropping.

However, Master student cannot drop more than one semester during his program while PhD students cannot drop more than two semesters.

5.3. Withdrawal and Interruption

A. Withdrawal

A student who voluntarily withdraws from a master program will be treated as a new applicant on deciding to rejoin. All updates of conditions will be applied to his case. The withdrawal becomes effective when accorded with the following regulations:

- a) The student should apply (for withdrawal) to the Deanship of Graduate Studies before the commencement of final exams.
- b) The Deanship of Graduate Studies ought to notify both the Deanship of Admission and Registration and the relevant department of a student's withdrawal in two-week time from the date of completion of withdrawal procedures.

B. Interruption of Study

The student shall be considered as a dropout and his record as closed in the following cases:

- a) If accepted in the program and did not register on time.
- b) If registered in the courses and did not attend them.

5.4. Transfer Between Disciplines

- a. Transfer of student from one discipline to another would be restricted within the acceptance of both disciplines involved. Disciplines will decide on the basis of their criterion to allow the transfer.
- b. A graduate student can transfer from the non-thesis program to the thesis program if the student gets approval from one of the faculty to be his supervisor.
- c. Local graduate Students are allowed to transfer from thesis program to non-thesis program.

- d. International graduate students are allowed to transfer from the thesis program to non-thesis program excluding students that have a scholarship from King Saud University to pursue their degree.

6. Study Plan for M.Sc. Program Students

6.1. Study Plans in Civil Engineering Department

- a. The M.Sc. degree requirements for **Master-Thesis plan (Plan A)** are as follows:

Completing **26 credit hours** of course work from the approved graduate courses as follows:

- 9 credit hours of common courses, as given in Table 6-A
- 15 credit hours of specialized Civil Engineering courses chosen from one of the areas of specializations mentioned above, as given in Tables 6-B to 6-G according to the applicant's specialization.
- Satisfactory completion of the M.Sc. thesis (2 credit hours).

Program Structure		No. of Courses	Credit Hours
Course	Required (Common Courses)	3	9
	Specialty Elective	5 (5 courses are selected from the list of courses in each specialty)	15
Thesis (if any)		2	2
Total		10	26

- b. The M.Sc. degree requirements for **Master-Non-Thesis (course based) plan (Plan B)** are as follows:
- Passing **42 credit hours** of Master's courses including the research project
 - General Elective course means that it can be taken from any specialty.

Program Structure		No. of Courses	Credit Hours
Course	Required (Common Courses)	3	9
	Specialty Elective	7 (7 courses are selected from the list of courses in each specialty)	21
	General Elective	3 (3 courses can be selected from any list of courses of any specialty)	9
Research Project (if any)		1	3
Total		14	42

6.2. M.Sc. Program Courses in Civil Engineering Department

Table 6-A. Common Courses

SN	Course Code	Course Name	Credit Hours
1	STAT 503	Probability and Mathematical Statistics	3
2	MATH 505	Numerical Linear Algebra	3
3	CE 572	Computer Applications in Civil Engineering	3

Table 6-B. Courses in Construction Engineering and Management

SN	Course Code	Course Name	Credit Hours
1	CE 511	Construction Planning and Control	3
2	CE 512	Construction Management	3
3	CE 513	Construction Engineering	3
4	CE 514	Decision Making and Risk Management in Construction	3
5	CE 515	Cost Analysis and Control	3
6	CE 516	Construction Engineering Contracts	3
7	CE 517	Computer Applications in Construction	3

Table 6-C. Courses in Structural Engineering

SN	Course Code	Course Name	Credit Hours
1	CE 563	Advanced Structural Analysis	3
2	CE 564	Advanced Solid Mechanics	3
3	CE 565	Theory of Plates and Shells	3
4	CE 566	Plasticity in Structural Engineering	3

SN	Course Code	Course Name	Credit Hours
5	CE 567	Stability of Structures	3
6	CE 568	Structural Dynamics	3
7	CE 569	Finite Element Method in Structural Analysis	3
8	CE 573	Behavior of Metallic Structures	3
9	CE 574	Behavior of Reinforced Concrete Members	3
10	CE 575	Prestressed Concrete Structures	3
11	CE 576	Structural Reliability	3
12	CE 577	Advanced Concrete Technology	3
13	CE 579	Special Topics in Structural Engineering	3

Table 6-D. Courses in Water Resources Engineering

SN	Course Code	Course Name	Credit Hours
1	CE 501	Design of Hydraulic Structures	3
2	CE 520	Advanced Hydraulics	3
3	CE 522	Groundwater Hydrology	3
4	CE 525	Surface Water Hydrology	3
5	CE 527	Water Resources Planning	3
6	CE 528	Water Resource Systems Analysis	3
7	CE 529	Special Topics in Water Resources & Hydraulics	3

Table 6-E. Courses in Geotechnical Engineering

SN	Course Code	Course Name	Credit Hours
1	CE 581	Advanced Soil Mechanics	3
2	CE 582	Advanced Shallow Foundation Engineering	3
3	CE 583	Retaining Structures and Slopes	3
4	CE 584	Geotechnical Measurements and Exploration	3
5	CE 585	Applied Rock Mechanics	3
6	CE 588	Numerical Methods in Geotechnical Engineering	3
7	CE 589	Special Topics In Geotechnical Engineering	3

Table 6-F. Courses in Environmental Engineering

SN	Course Code	Course Name	Credit Hours
1	CE 506	Environmental Chemistry	3
2	CE 508	Physicochemical Treatment Processes	3
3	CE 509	Biological Treatment Processes	3

SN	Course Code	Course Name	Credit Hours
4	CE 543	Planning and Design of Water and Wastewater Networks	3
5	CE 544	Environmental Air Pollution	3
6	CE 546	Solid Waste Management	3
7	CE 547	Industrial and Hazardous Waste Management	3
8	CE 549	Special Topics in Environmental Engineering	3

Table 6-G. Courses in Transportation Engineering

SN	Course Code	Course Name	Credit Hours
1	CE 531	Traffic Flow Characteristics	3
2	CE 532	Advanced Transportation Planning	3
3	CE 534	Traffic Flow Operation and Control	3
4	CE 536	Advanced Geometric Design of Highways	3
5	CE 537	Advanced Pavement Design	3
6	CE 538	Pavement Evaluation and Maintenance	3
7	CE 599	Special Topics in Transportation	3

Table 6-H. Thesis and Project Courses

SN	Course Code	Course Name	Credit Hours
1	CE 598	Research Project in Plan B	3
2	CE 596	Thesis Research Proposal	1
3	CE 600	Thesis in Plan A	1

The course descriptions and needed references for each course are given in **Appendix A**, while the associated textbooks of all courses are given in **Appendix B**

7. Funding of Graduate Students

7.1. Research Funds from DSR

Graduate Student can apply through Deanship of scientific research by following the below steps.

- a. Submit the proposal to the Research Center by filling out the required form and sending it to e-mail: HGDSR@ksu.edu.sa. For more details student should contact deanship of scientific research at <http://dsrs.ksu.edu.sa>.
- b. Attach a copy of t of research plan approval which approved from the Deanship of Graduate Studies
- c. The proposal is reviewed and verified by the Research and Finance Support Unit.

7.2. Research Funds from KACST

Student can also apply to The Grants Program for Universities and Research Centers (GPURC) at King Abdulaziz City for Science and Technology (KACST's) through <https://www.kacst.edu.sa/eng/srs/Pages/Grants-Program-Universities-Research-Centers.aspx>.

7.3. Stipends

Stipends are paid to all Saudi students attending undergraduate and graduate studies and not having in any governmental job, as well as foreign scholarship students and students of Saudi mothers .Stipends are deposited in students' bank accounts, noting that ATM cards are given to them by their respective colleges. The stipend amount is (SR 1000) for scientific studies students,(SR 850) for social studies and humanities students, and (SR900) for graduate studies students.

- Stipends are paid regularly during all the original period, i.e. , the scheduled program period for graduation according to the study plan approved by the University Board. For example, the original period of the Art Faculty is four years. It is calculated as of the semester in which the student is admitted to the university, including withdrawal and transfer semesters , but excluding deferral semesters.

7.4. Book and Reference Allowance for Graduate Students

The graduate student is paid (SR 900) as books and reference allowance for each academic year, (SR 3000) printing allowance for the Master's thesis, and (SR 4000) for the PhD dissertation.

- The book and reference allowance is deposited in the student's account (non-employee) if his/her student number begins with 430 and above. Conditionally, he has registration and grades entered in the same semester. However, the student can receive the allowance from the accountant in his college if his student number begins with 429 and below. As for the graduate student who is employed at King Saud University, he/she can receive the allowance from the Deanship of Personnel.
- The Master's thesis and PhD dissertation printing allowance is deposited in the student's account (non-employee) after a grade is entered for him/her in the same graduation semester provided that his status on the academic system is graduated. As for the graduate student who is employed at the University of King Saud, he can receive printing allowance for the above-mentioned printing allowance from the Deanship of Personnel.

7.5. Support for Travel

Every graduate student registered at KSU is eligible to apply for support for research travel from the Graduate Studies Deanship, e.g., to conferences. At present this support is once per program. The Conference Travel Grant forms must be submitted no later than one month before the conference and require the Department and College Approval. Student should apply online through electronic service of Graduate studies website at <https://eservices.ksu.edu.sa/ACGS/>.

8. Deanship of Graduate Studies

For more information, you are encouraged to visit the Deanship of Graduate Studies to <https://graduatestudies.ksu.edu.sa/en>

PART C. STUDENT LIFE

Less than 10 km from Center of Riyadh King Saud University campus provides a safe, supportive culture for undergraduate and graduate students alike. We offer a wide range of services to help with housing, academic support, internships and career planning. Diverse and engaged, our community keeps the campus lively with a variety of events, activities, clubs and organizations.

1. Living Expenses

The following costs reflect average living costs for a single person living in Riyadh, Saudi Arabia.

ITEMS	ESTIMATED COST
Housing	<i>In campus:</i> Free furnished airconditioned bachelor housing. <i>Out of campus:</i> Unfurnished apartment (2BR) 15,000 – 20,000 SR/year
Transportation	Parking is free in campus. Taxi: 1,000~1,500 SR per month
Utilities (Water + Electricity)	<i>In campus:</i> Free <i>Out of campus:</i> 300 SR
Internet	Free in campus <i>Out of campus:</i> 100 SR/ month
Food	250 SR per month in student restaurant at university campus <i>Outside campus:</i> 25~50 SR/meal
Entertainment	Free in campus
Books (varies by program)	50% discount for all students
Total estimated living costs	<i>In campus:</i> 1,000 SR / student-month <i>Out of campus:</i> it depends.

This information has been compiled to provide you with estimates of the costs you may encounter while you're a graduate student at KSU in Riyadh.

2. Student Housing

All students who live on campus have a private room that includes basic furniture such as a bed, chair and desk. The University provides student housing for the total student enrollment in keeping with its policy of being an entirely residential institution. The multi-story student housing consists of furnished rooms, having two beds per room, showers and hygienic facilities. These units are equipped with new facilities of modern design, consistent with the architecture of the University. All the student housing is provided with parking to house student vehicles. All student housing can get free access to theaters, multi-sport leisure centers, parking, swimming pool, and playground. Also, Internet in campus is free of charge for all students.

The student-housing department uses an effective electronic system to manage student accommodation whereby students can submit their applications and execute a number of housing services electronically. In addition, they are kept well informed about available lists of housing, and they can register in the lists announced every semester. Housing off campus is also available, to assist students with finding off-campus housing, Off Campus Programs and Services works with a third-party vendor (real state offices). For more detail: <https://sa.ksu.edu.sa/ar/HousingMale>



Student Housings in Campus



Category A – Single room



Category B – Single or Double Room

3. Dining Options

There are a variety of options for students to dine in and out of campus. In campus, the University Cafeteria offers subsidized meals for breakfast, lunch and dinner that serves all students especially those are living in campus. This Cafeteria is located in a large spacious building that can accommodate more than 1500 students at a same time. Also, there are many restaurants, cafés, and small markets that are located throughout the campus and offer a wide variety of cuisines and refreshments (sandwiches, home-style food, pizza, ethnic cuisines and more) for both students and staffs. In addition, there are many international cuisine restaurants around the campus. These restaurants can be reached easily using taxi or private car, or by ordering for delivery.



Student Cafeteria in Campus

4. Health Care

All care is free of charge for all King Saud University staff and students at King Khalid University Hospital and King Abdulaziz University Hospital



University Hospitals

5. Campus Safety

While Riyadh is a very safe city to live, work and study, it is always advisable to follow some simple steps that will give you extra vigilance and more peace of mind. Many students and staff also travel extensively in relation to their work with the University.

The campus safety department is the College's authorized security force tasked with enforcing its rules, regulations and policies. Enforcement procedures include issuing parking tickets and summary fines, filing conduct charge sand providing vehicle registration and ID card services.

IMPORTANT PHONE NUMBERS:

- Office: 00966-11-4677837
- Email: secure@ksu.edu.sa

6. Student Activities Department

There is a number of student activity clubs which are supervised by each Department. Students can easily find the student clubs in their disciplines in the University, also they can find clubs for sports, social, cultural and art activities. For the Student Club Activities, the University may provide financial support. The activities of the student clubs focus not only on arranging training courses, scientific & technical visits, scientific competitions, special lectures, exhibitions, cultural exchanges, art, sports activities, but also on representing the University in many seminars, conferences, and forums in the Kingdom and/or internationally. AReserved offices and halls will be allocated for club members.

7. Sports and Recreation Facilities

Each year students are provided an opportunity for fun, fitness, and competition through a wide variety of activities sponsored by the Dean of Student Affairs. Organized team and individual competition for student are offered. Sport clubs are ongoing programs in which students may participate. The University's major sports facility is the Stadium, located near the main entrance to the University. It is designed to seat 25,000 spectators. The Stadium is open and has facilities for VIP seating, press box, and TV booths. It is consistent with the style and construction of all other permanent buildings within the Academic Complex.

Other facilities available for free are: swimming pools, changing rooms, soccer fields, tennis courts, athletics track, basketball and volleyball courts, handball courts, squash courts, and athletic support facilities. And each Colleges have recreation rooms in their buildings for students.



Swimming Pool and Sports Complex

8. Local Attractions

Riyadh is a place that you will surely love. It has lots of things and places for both expats and locals to enjoy. There are different ways to explore this beautiful city. There are numbers of awesome things and attraction places that you may to do in Riyadh city, such

- Sky Bridge at Kingdom Center
- Alfaisaliah Tower
- Wadi Namar and Hanifa
- Tour at the largest integrated farm in the world (Almrai)
- Quad biking at the red sand dunes
- Edge of the world
- Visit the national museum.
- A walk in the past at the historical places (Al Bujairi square, Masmak citadel, old Dir'aiyah)
- Shopping malls (Riyadh Gallery Mall, Riyadh Park, Al-Nakheel Mall, Alfaisaliah Mall et.)

APPENDIX A. COURSE DESCRIPTIONS

1. Common Courses

SN	Course Code	Course Name	Short Description
1	STAT 503	Probability and Mathematical Statistics	Postulates of probability, random variable, probability distributions, mathematical expectation, probability densities. Sampling distribution, point estimation, internal estimation, confidence intervals. Correlation and regression analysis, analysis of variance. Tests of hypothesis, tests based on count data, nonparametric tests.
2	MATH 505	Numerical Linear Algebra	Linear equations and matrix analysis. Approximation of functions, error analysis. Special matrices, error analysis for linear systems, iterative methods, computation of eigen value and eigen vectors.
3	CE 572	Computer Applications in Civil Engineering	Problem solving programs: Spreadsheet and MATLAB. Mathematical programs: numerical integration, solution of differential and nonlinear equations. Statistical programs: analysis, modeling and testing of data. Logical and optimization programs. Database, artificial intelligence and expert system programs. Applications to all civil engineering disciplines. Project.

2. Courses in Construction Engineering and Management

SN	Course Code	Course Name	Short Description
1	CE 511	Construction Planning and Control	This course provides the students an opportunity to study and apply a different planning and scheduling tools and techniques throughout a life cycle of a project.
2	CE 512	Construction Management	Advanced study and analysis of construction top and upper-middle management responsibilities, on construction management, construction financing, construction safety, inspection and quality control, and disputes and claims. Stresses investigations to improve construction management efficiency and to lower construction costs.
3	CE 513	Construction Engineering	Introduction to the economics, utilization and limitations of large-scale horizontal construction methods. Advanced study of planning, analysis, and methods improvement techniques as applied to public works and energy facilities construction. Emphasizes computer simulation of construction operations and time lapse analysis.
4	CE 514	Decision Making and Risk Management in Construction	Concepts and current issues surrounding construction project evaluation and financing. The use of decision theory in evaluating project feasibility studies. Decision making under conditions of risk and uncertainty.

SN	Course Code	Course Name	Short Description
5	CE 515	Cost Analysis and Control	Central to the construction manager skills is the knowledge of cost accounting, financial analysis, and cost control. To fulfill such requirement, the student is exposed to building up estimates and bids where subsequent strategic decision making for pricing and profit are made in various real life civil engineering projects.
6	CE 516	Construction Engineering Contracts	Basics of contract law; types and selection of construction contracts; essentials of plans and specifications; bidding, awarding and administration of contracts; liability, bonding claims, and other legal aspects associated with construction projects.
7	CE 517	Computer Applications in Construction	Microcomputer applications in construction management, planning, scheduling, cost estimate, and risk analysis. Should also gain exposure to the use of expert systems, data bases and other integrated packages.

3. Courses in Structural Engineering

SN	Course Code	Course Name	Short Description
1	CE 563	Advanced Structural Analysis	Energy principles, stiffness and flexibility methods, and their applications to non-prismatic members, arches, rings, curved members, cables, frames with semi-rigid connections.
2	CE 564	Advanced Solid Mechanics	Introduction to elasticity: stress; strain; equilibrium; compatibility; constitutive relations. Selected topics in advanced mechanics of materials: torsion of non-circular solid and thin-wall open and hollow sections; unsymmetrical bending; shear center; shear deformations in beams; curved beams; failure theories; beams on elastic foundations.
3	CE 565	Theory of Plates and Shells	Stresses and deformations in a plate element. Theory of thin elastic plates. Classical solution of rectangular and circular plates. Numerical techniques of Rayleigh-Ritz. Large deflection theory of plates. Stresses and deformations in a shell element. Membrane and bending theories of thin shells.
4	CE 566	Plasticity in Structural Engineering	Fundamentals of theory of plasticity; Inelastic behavior of sections, members and structures; Fundamentals and basic theories of limit analysis; Applications of limit analysis applications to plane concrete and metal structures; Plastic design of continuous beams and frames.
5	CE 567	Stability of Structures	Bending of structural members subjected to axial and lateral loads; Elastic and inelastic buckling of compression members; Torsional and lateral buckling of beams; Local buckling; Instability of frames, plates and shells.
6	CE 568	Structural Dynamics	Vibrations and dynamic response of structures; free and forced vibration, response to foundation excitation. Response spectrum

SN	Course Code	Course Name	Short Description
			concept. Single-degree & multi-degree of freedom systems with lumped and consistent mass. Seismic design load.
7	CE 569	Finite Element Method in Structural Analysis	Introduction to Finite Element Method; Direct formulation of finite element in one dimension; stiffness method for truss, beam and frame analysis; Weighted residuals; Energy and Variational principles in elasticity; Rayleigh-Ritz method; Shape functions and finite element formulation; Lagrangian and Serendipity elements; Isoparametric elements and Numerical integrations; Finite Element Implementation to 2-D Plane Stress/Plane Strain and Axisymmetric problems.
8	CE 573	Behavior of Metallic Structures	The course covers applications of advanced concepts in the design of steel structures with emphasis on the role of member stability in the analysis and design of steel structures, behavior and design of built-up compression members, behavior and design of plate girders, behavior and design of composite steel beams and columns, as well as behavior and design of bolted and welded connections with different load conditions, according to LRFD method and Saudi Building Code Provisions.
9	CE 574	Behavior of Reinforced Concrete Members	Behavior of reinforced concrete members under imposed loads and deformations. Reinforced concrete materials: factors affecting strength and deformability, stress/strain relations, and confinement. Short compression members and flexure and axial load: sectional analysis, hinging and ductility of members, and deformations. Beams, short columns, and slender Columns. Shear: sectional design, compression field theories, and Truss analogy (strut-and-tie models). Anchorage: bond and development of bars, splices, hooks, mechanical devices, and Structural continuity. Beam-column connections and shear walls.
10	CE 575	Prestressed Concrete Structures	Prestressing of statically indeterminate structures, prestressing losses; prestressed concrete slabs; partially prestressed concrete beams; members with unbonded tendons; coordination between design and construction techniques in prestressing. Relevant code provisions.
11	CE 576	Structural Reliability	Common probability models. Principles of structural reliability. First and second order methods. Simulation techniques. Probabilistic models for loads and resistance variables. Probability-based design criteria and Design Codes; quantitative risk evaluation, safety and load factor determination.
12	CE 577	Advanced Concrete Technology	Microstructure of cement paste; Elasticity of concrete, Temperature effects in concrete; Concrete-environment interactions, Time-dependent deformations of concrete: Creep and shrinkage; Special cements, fiber reinforced concrete and polymer concrete systems.
13	CE 579	Special Topics in Structural Engineering	This course deals with special topics in structural engineering which are of contemporary interest.

4. Courses in Water Resources Engineering

SN	Course Code	Course Name	Short Description
1	CE 501	Design of Hydraulic Structures	Design of hydraulic structures, such as canals, drains, culverts, head works, outlet works, regulators, falls, canal transitions, cross drainage works, dams , spillways, energy dissipation structures and flood control structures.
2	CE 520	Advanced Hydraulics	Steady pipe flow theory and computations. Design and analyses of sewer network system. Design and analysis of transmission lines. Design and analysis of distribution networks. Unsteady flow; Gradually varied unsteady flow and Rapidly varied unsteady flow, Transient flow equations and methods of solution.
3	CE 522	Groundwater Hydrology	Introduction to groundwater hydrology; occurrence, storage and supply of groundwater; basic differential equations for flow in confined and unconfined aquifers. Steady and unsteady groundwater wells and hydraulics problems; groundwater recharge; saline water intrusion; groundwater modeling; groundwater in Saudi Arabia.
4	CE 525	Surface Water Hydrology	Introduction to surface water hydrology, hydrologic cycle. Hydrologic Principles. Precipitation, Evaporation, Infiltration and Soil Water Movement. Unit hydrograph, Flood hydrograph computation. flood forecasting and frequency analyses; flood; Hydrologic simulation using HEC-HMS.
5	CE 527	Water Resources Planning	Principles and standards for planning water resources; water uses and water supply alternatives; benefit-cost analysis, economic and financial analysis; environmental impact assessment, legal and institutional aspects; elements of project formulation and appraisal, programming water resources investigations.
6	CE 528	Water Resource Systems Analysis	Introduction to system engineering optimization by calculus, linear and nonlinear programming, dynamic programming, simulated annealing, chance constraints modeling, and decision analysis. Applications to water resources problems.
7	CE 529	Special Topics in Water Resources & Hydraulics	Any special topic related to Water Resources and Hydraulics not covered in the courses. The selected topics may cover flood damage assessment, flood control strategies and systems, application of remote sensing and GIS in rainfall runoff modeling. Such topics depend on student interest and faculty expertise.

5. Courses in Geotechnical Engineering

SN	Course Code	Course Name	Short Description
1	CE 581	Advanced Soil Mechanics	Stress-strain relations, elasticity equations, shear strength theories. Principles of effective stress in saturated and

SN	Course Code	Course Name	Short Description
			partially saturated soils. Classical plasticity theory, critical state concept. Geosynthetics (Types, properties, & function)
2	CE 582	Advanced Shallow Foundation Engineering	Development of design skills in foundation engineering for upnormal soil type and condition, such as foundation on layered soil , sabkha soil ,expansive soil , collapsing soil , weathered and fractured rock material.
3	CE 583	Retaining Structures and Slopes	Limit equilibrium and limit analysis methods. Pressures on earth retaining structures. Analysis, design, and construction of retaining structures. Stability of natural and man-made slopes under various loading conditions.
4	CE 584	Geotechnical Measurements and Exploration	Planning and execution of subsurface exploration. Exploratory holes and sampling. Field instrumentation and testing. Generation of field parameters. Interpretation of field data for planning and design. Special laboratory tests
5	CE 585	Applied Rock Mechanics	This course is designed to exposure the student to the applications of rock mechanics in engineering practice and to develop his skills with regard to assessment and evaluation of rock mechanics related projects.
6	CE 588	Numerical Methods in Geotechnical Engineering	Numerical versus analytical solution. Approximation and solution of governing differential equations. Basic principles of finite elements, finite difference, and boundary elements methods. Numerical solutions of typical geotechnical engineering problems.
7	CE 589	Special Topics In Geotechnical Engineering	This course deals with special topics in geotechnical engineering which are of current interest.

6. Courses in Environmental Engineering

SN	Course Code	Course Name	Short Description
1	CE 506	Environmental Chemistry	The course provides comprehensive coverage of the chemistry of natural and polluted waters and on the applied chemistry of water and wastewater treatment. The course covers dilute aqueous solution chemistry of acid-base reactions, chemical kinetics, equilibrium principles, complex formation, precipitation and dissolution reactions, and oxidation-reduction reactions. These fundamental chemical principles are applied to the natural and polluted water, water, and wastewater treatment processes.
2	CE 508	Physicochemical Treatment Processes	Fundamentals of process kinetics and reactor engineering. Aeration and gas transfer, coagulation and flocculation, sedimentation, filtration, and disinfection. Adsorption, ion exchange and membrane processes. Chemical sludge treatment and handling.

SN	Course Code	Course Name	Short Description
3	CE 509	Biological Treatment Processes	Kinetics of biological growth. Modeling of suspended and attached growths. Aerobic treatment processes: Trickling filters, rotating biological contactors, activated sludge, Aerated lagoons and stabilization ponds. Sludge treatment.
4	CE 543	Planning and Design of Water and Wastewater Networks	Development of design skills in water distribution and wastewater collection networks: Estimation of flows; systems layout and planning; selection and setting of design criteria; computer network analysis and design. Preparation of design reports for selected local projects.
5	CE 544	Environmental Air Pollution	Air pollutants causes, sources, and effect; air emission standards; design of equipment and system for removal of particulate and gaseous pollutants emitted from stationary source; air pollution and meteorology, emission dispersion equations and modeling.
6	CE 546	Solid Waste Management	Study of the engineering and management principles, practices, and techniques for the management and disposal of solid wastes. Topics include characteristics, generation, transport, processing, resource recovery, disposal, landfill design and operation, leachate management, and contaminant transport.
7	CE 547	Industrial and Hazardous Waste Management	Definition and characteristics of industrial and hazardous wastes. Industrial and hazardous waste generation rates and prevention. Introduction to Industrial and hazardous waste collection, transportation, treatment, monitoring, and disposal. Applicable international, federal, and provincial regulations and initiatives. Municipal services and planning associated with industrial and hazardous waste management. Physical, chemical and biochemical treatment technologies, and disposal methods, including landfilling and incineration. Environmental impact of industrial and hazardous waste management.
8	CE 549	Special Topics in Environmental Engineering	Study of special topics in environmental engineering with emphasis on current problems. Participants are expected to write a report and give an oral presentation on an environmental topic of their choice and of local concern. The work may include literature search, laboratory work and field investigation.

7. Courses in Transportation Engineering

SN	Course Code	Course Name	Short Description
1	CE 531	Traffic Flow Characteristics	An overview of microscopic and macroscopic traffic flow characteristics (flow, speed & density), and their associated techniques such as traffic Stream modeling, capacity and level of service analysis, shock wave analysis, supply-demand analysis, queuing analysis, and simulation modeling.
2	CE 532	Advanced Transportation Planning	This course offers a detailed treatment of the long-term strategic planning aspects of transport systems. The course provides a broad overview of the concepts, issues, techniques, and possible solutions involved in transport planning and evaluation, including environmental and economic considerations. The course focuses on the issues of assessing sustainable development and its relevance in transport, and the problems it poses to transport planning in developing a sustainable transport system.
3	CE 534	Traffic Flow Operation and Control	The course will give master students an overview of concepts in traffic operations and control. Primarily this course will focus on the application of traffic control methods and devices to improve capacity and safety of urban street systems. Emphasis will also be put on the computer aids and the new technology of signal systems, and highway operations.
4	CE 536	Advanced Geometric Design of Highways	Design designations and criteria. Integration between horizontal and vertical alignments. At-grade intersections; types and design elements. Interchanges: types and design elements. Design of parking facilities and appurtenances. Surface Drainage. Safety considerations.
5	CE 537	Advanced Pavement Design	The course provides master students advanced topics in pavement analysis and design. The course also includes topics related to pavement rehabilitation. The course covers distresses in flexible and rigid pavements (types, causes, and suggested repair), analysis of pavement performance, evaluation of the structural condition of a pavement, analysis of elastic and viscoelastic layer system, mechanistic-empirical pavement design (AASHTOWare Pavement ME Design), sustainable pavement practices and perpetual pavement, and overlay design for both flexible and rigid pavements. The course may include a brief review on advanced pavement materials testing if the student does not have a previous knowledge. Beside these topics, the course attempts to address recent topics related to pavement design through reviewing recently published research. The course also includes report/research assignments on the topics covered.
6	CE 538	Pavement Evaluation and Maintenance	Development of skills in pavement evaluation and maintenance: pavement performance; distresses identification; visual inspection; roughness measurements; skid resistance; structural evaluation; levels and methods of maintenance; and economic analysis of pavement maintenance strategies.

SN	Course Code	Course Name	Short Description
7	CE 599	Special Topics in Transportation	This course covers a wide range of topics of current interest in planning, design, construction, operation, maintenance and / or management of transportation systems. The specific subject will be selected based on the need, student interest and faculty expertise.

8. Thesis and Project Courses

SN	Course Code	Course Name	Short Description
1	CE 598	Research Project in Plan B	Research Project provides students with the opportunity to understand the research process, and to participate in it by analyzing, presenting and writing up their research results. The students' research projects are supervised by the Course Convener.
2	CE 596	Thesis Research Proposal	This course is open to students developing Master's thesis students who wish to develop a dissertation or independent research proposal in a structured setting
3	CE 600	Thesis in Plan A	The Master's Thesis course runs throughout a full semester and constitutes the final and concluding task in the Master Program in civil engineering. During this course, students will study research methods, will design and do an empirical and/or experimental study and present this in a written report called a Master's thesis and presenting the work in oral presentation.

APPENDIX B. COURSE TEXTBOOKS

1. Common Courses

SN	Course Code	Course Name	Textbooks
1	STAT 503	Probability and Mathematical Statistics	<ul style="list-style-type: none"> Applied Linear Algebra using MATLAB, Pages: 518, Heldermann Verlag Press, (2008), by R. Butt. Numerical Linear Algebra and Optimization using MATLAB, Pages: 1160, Mercury Learning and Information, (2011), by R. Butt. An Introduction to Applied Numerical Linear Algebra Using MATLAB; Pages: 642, Alpha Science International Ltd., Oxford, United Kingdom, (2015), by R. Butt.
2	MATH 505	Numerical Linear Algebra	<ul style="list-style-type: none"> Probability and Statistics for Engineers and Scientists. By: R.E.Walpole and R.H.Myers
3	CE 572	Computer Applications in Civil Engineering	<ul style="list-style-type: none"> T. Young and M. J. Mohlenkamp (2017). Introduction to Numerical Methods and MATLAB Programming for Engineers., Ohio University, Athens: http://www.math.ohiou.edu/courses/math3600/book.pdf S.M. Ross (2009). Probability and Statistics for Engineers and Scientists, Fourth Edition, Academic Press, Canada. Messac (2015). Optimization in Practice with MATLAB for Engineering Students and Professionals, Cambridge University Press, USA. Samuel J. Biondo (1990) Fundamentals of Expert Systems Technology: Principles and Concepts, Intellect Books.

2. Courses in Construction Engineering and Management

SN	Course Code	Course Name	Textbooks
1	CE 511	Construction Planning and Control	<ul style="list-style-type: none"> Construction Planning and Scheduling (4th Edition) by Jimmie W. Hinze, 2011. Project Management with CPM, PERT, and Precedence Diagramming, 3rd Edition, by Moder J., Phillips, C., and Davis, E. International Project Management, Academic Press, 2003, Miner Media, Eng Mgt 461, International Case Studies, Bennet Lientz and Kathryn Rea, (ISBN-0-120449985-6). Eldosouky, A.I., Principles of Construction Project Management, Tanta University, 2001.
2	CE 512	Construction Management	<ul style="list-style-type: none"> Harris, F., & McCaffer, R. (2013). Modern construction management. John Wiley & Sons.

SN	Course Code	Course Name	Textbooks
			<ul style="list-style-type: none"> Dainty, A., Moore, D., & Murray, M. (2007). Communication in construction: Theory and practice. Routledge
3	CE 513	Construction Engineering	<ul style="list-style-type: none"> R. L. Peurifoy, C. J. Schexnayder, A. Shapira, and R Schmitt, Construction Planning, Equipment, and Methods, McGraw-Hill Publishing Company
4	CE 514	Decision Making and Risk Management in Construction	<ul style="list-style-type: none"> Singh, Amarjit, and C. Eng. "Quantitative Risk Management and Decision Making in Construction." American Society of Civil Engineers, 2017.
5	CE 515	Cost Analysis and Control	<ul style="list-style-type: none"> Schuette, Stephen D. and Liska Roger W. Building Construction Estimating. McGraw-Hill Higher Education, Inc. USA. Robert L. Peurifoy and Garold D. Oberlender. Estimating Construction Costs. McGraw-Hill Higher Education, Inc. USA. James J. Adrian. Construction Estimating: An Accounting and Productivity Approach. Prentice-Hall Inc., Upper Saddle River, NJ, USA. Steven J. Peterson. Construction Accounting and Financial Management, Pearson Higher Education, Inc. Upper Saddle River, NJ, USA.
6	CE 516	Construction Engineering Contracts	<ul style="list-style-type: none"> Collier, Keith (2011). Construction Contracts. 3rd Edition, Prentice-Hall, Inc., Upper Saddle River, New Jersey
7	CE 517	Computer Applications in Construction	<ul style="list-style-type: none"> Schwalbe, K. (2015). Information technology project management. Cengage Learning. Hegazy, T. (2002). Computer-Based Construction Project Management: Pearson New International Edition. Pearson Higher Ed. Paulson Jr, B. C. (1994). Computer applications in construction. McGraw-Hill, Inc. Williams, T. (2006). Information Technologies for Construction Managers, Architects and Engineers. Thomson Delmar Learning. Hardin, B., & McCool, D. (2015). BIM and construction management: proven tools, methods, and workflows. John Wiley & Sons International Project Management, Academic Press, 2003, Miner Media, Eng Mgt 461, International Case Studies, Bennet Lientz and Kathryn Rea, (ISBN-0-120449985-6).

3. Courses in Structural Engineering

SN	Course Code	Course Name	Textbooks
1	CE 563	Advanced Structural Analysis	<ul style="list-style-type: none"> Igor A. Karnovsky and Olga Lebed (2010). Advanced Methods of Structural Analysis. Springer. William McGuire, Richard Gallagher, and Ronald Ziemian. Matrix Structural Analysis. 2nd Edition, John Wiley & Sons, Inc.
2	CE 564	Advanced Solid Mechanics	<ul style="list-style-type: none"> A.P. Boresi, R.J. Schmidt, Advanced Mechanics of Materials, John Wiley & Sons, Inc., 6th Edition., 2003. Ferdinand Beer .. et al., Mechanics of Materials, McGraw-Hill, latest edition.
3	CE 565	Theory of Plates and Shells	<ul style="list-style-type: none"> Eduard Ventsel and Theodor Krauthammer, "Thin Plates and Shells - Theory, Analysis, and Applications", Marcel Dekker, Inc. 2001 Timoshenko, S.P. Winowsky. S., and Kreger, "Theory of Plates and Shells", McGraw-Hill Book Co. 1990. Ugural, A. C. Stresses in Plates and Shells. 2nd ed. New York, NY: McGraw-Hill, 1998
4	CE 566	Plasticity in Structural Engineering	<ul style="list-style-type: none"> Neal, B.G., 1985. The plastic methods of structural analysis. 3rd Ed. John Wiley & Sons. Wight, J. K. Reinforced Concrete: Mechanics and Design. Global Edition." (2016)-Chapter 14 Chakrabarty, J., 2016. Theory of plasticity. 3rd Ed. Elsevier. Chen, W.F. and Han, D.J., 2007. Plasticity for structural engineers. J. Ross Publishing.
5	CE 567	Stability of Structures	<ul style="list-style-type: none"> Bazant ZP, Cedolin L. Stability of structures: elastic, inelastic, fracture, and damage theories. Courier Corporation; 2003.
6	CE 568	Structural Dynamics	<ul style="list-style-type: none"> Dynamics of Structures: Theory and Applications to Earthquake Engineering by Anil K. Chopra, 4th SI Edition, Pearson-Prentice Hall, 2014
7	CE 569	Finite Element Method in Structural Analysis	<ul style="list-style-type: none"> Y. M. Desai, T. L. Eldho, A. H. Shah, Finite Element Method with Applications in Engineering, Pearson India., 2011. J. N. Reddy, Introduction to the Finite Element Method, 3rd edition, McGraw-Hill Education, 2006
8	CE 573	Behavior of Metallic Structures	<ul style="list-style-type: none"> Structural Steel Design", Jack C. Mc Cormac,& Stephen Csernak, Latest Edition, Pearson Education Limited. Steel Structures: Controlling Behavior Through Design", Robert E. Englekirk, 1st Edition, John Wiley and Sons Ltd, 1994
9	CE 574	Behavior of Reinforced Concrete Members	<ul style="list-style-type: none"> Reinforced Concrete: Mechanics and Design, (7th) Edition, James K.Wight. (2015)
10	CE 575	Prestressed Concrete Structures	<ul style="list-style-type: none"> Prestressed Concrete Analysis and Design: Fundamentals by Antoine E. Naaman. Techno Press; 3rd edition, 2012.

SN	Course Code	Course Name	Textbooks
11	CE 576	Structural Reliability	<ul style="list-style-type: none"> Reliability of Structures by A. S. Nowak and K. R. Collins, McGraw-Hill, International Edition 2000.
12	CE 577	Advanced Concrete Technology	<ul style="list-style-type: none"> Mindess, S., and Young, F.J., Concrete, 2nd Edition, 2002.

4. Courses in Water Resources Engineering

SN	Course Code	Course Name	Textbooks
1	CE 501	Design of Hydraulic Structures	<ul style="list-style-type: none"> Hydraulic structures, 4th Edition: P. Novak, A.I.B. Moffat, C. Nalluri and R. Narayanan, Taylor and Francis Group, ISBN:9780415386265 Theory and Design of Irrigation Structures Vol. II , Latest Ed, R. S. Varshney et al Mays, L. W.. Water Resources Engineering (2nd ed.). Wiley. Todd D.K., Ground Water Hydrology, John Wiley and Sons, 2000. Haestad Methods, Donald V. Chase, Dragan A. Savic, Thomas M. Walski., Water Distribution Modeling, Haestad; 1st edition (April 1, 2001). Nazih K. Shamma, Water Supply and Wastewater Removal, Wiley., Third edition, 2011. Mays, L. W.. Water Resources Engineering (2nd ed.). Wiley. Todd D.K., Ground Water Hydrology, John Wiley and Sons, 2000.
2	CE 520	Advanced Hydraulics	<ul style="list-style-type: none"> Bear J., Hydraulics of Groundwater, McGraw-Hill International, 1979. Haestad Methods, Donald V. Chase, Dragan A. Savic, Thomas M. Walski., Water Distribution Modeling, Haestad; 1st edition (April 1, 2001). Nazih K. Shamma, Water Supply and Wastewater Removal, Wiley., Third edition, 2011. Mays, L. W.. Water Resources Engineering (2nd ed.). Wiley. Todd D.K., Ground Water Hydrology, John Wiley and Sons, 2000.
3	CE 522	Groundwater Hydrology	<ul style="list-style-type: none"> Todd D.K., Ground Water Hydrology, John Wiley and Sons, 2000. Driscoll, F., Ground water and Wells, St. Paul, Minnesota, IIEd., 1986. Raghunath H.M., Ground Water Hydrology, Wiley Eastern Ltd., Second reprint, 2000. Willis, R. and W.W.G. Yeh, Groundwater Systems Planning and Management, Prentice-Hall, 1987. C. Walton, Groundwater Resources Evaluation, McGraw Hill, 1970. O.D.L. Strack, Groundwater Mechanics, Prentice Hall, 1989. S.P. Garg, Groundwater and Tube Wells, Oxford & IBH Publishing Co., 1993

SN	Course Code	Course Name	Textbooks
4	CE 525	Surface Water Hydrology	<ul style="list-style-type: none"> Dingman, S. L., 1994. Physical Hydrology. Prentice Hall, GB 661.2 D56 Chow, V. T., Maidment, D. R., and Mays, L. W., 1988, Applied Hydrology, McGraw- Hill, GB 661.2 C43 Brutsaert, W., Hydrology an Introduction, Cambridge University Press, 2005 Introduction to Surface Water Hydrology Modelling, J. Nossent and A. van Griensven
5	CE 527	Water Resources Planning	<ul style="list-style-type: none"> Grigg, N. S. (1985). Water resources planning. Millenium Development Goals Report 2014 (available online at www.un.org) Mays L.W. and Y.K. Tung, Hydrosystems Engineering and Management, McGraw-Hill, 1992. Dzurik, A. A., & Theriaque, D. A. (2003). Water resources planning. Rowman & Littlefield.
6	CE 528	Water Resource Systems Analysis	<ul style="list-style-type: none"> Mays L.W. and Y.K. Tung, Hydrosystems Engineering and Management, McGraw-Hill, 1992.

5. Courses in Geotechnical Engineering

SN	Course Code	Course Name	Textbooks
1	CE 581	Advanced Soil Mechanics	<ul style="list-style-type: none"> An Introduction to Geotechnical Engineering by Robert D. Holtz, William D. Kovacs, Thomas C. Sheahan, 2nd Edition.
2	CE 582	Advanced Shallow Foundation Engineering	<ul style="list-style-type: none"> INTRODUCTION TO ROCK MECHANICS. Second Edition, Goodman, Richard E., Published by John Wiley & Sons, 1989, ISBN 10: 0471617180 / ISBN 13: 9780471617181
3	CE 583	Retaining Structures and Slopes	<ul style="list-style-type: none"> Clayton, C. R. I., Woods, R. I., Bond, A. J., & Milititsky, J. (2014). Earth pressure and earth-retaining structures. Boca Raton: CRC Press. Duncan, J. M., Wright, S. G., & Brandon, T. L. (2014). Soil Strength and Slope Stability, 2nd Edition. John Wiley & Sons.
4	CE 584	Geotechnical Measurements and Exploration	<ul style="list-style-type: none"> Hand Book of Geotechnical Investigation and Design Tables 2007, Burt G. Look
5	CE 585	Applied Rock Mechanics	<ul style="list-style-type: none"> ROCK MECHANICS: theory and applications with case histories Wittke, W. 1990 SpringerBerlin Heidelberg New York Tokyo. EXPERIMENTAL ROCK MECHANICS, 1st Edition - Kiyoo Mogi, Reference - 361 Pages
6	CE 588	Numerical Methods in Geotechnical Engineering	<ul style="list-style-type: none"> Chapra, S. C. and Canale, R.P. (2010). "Numerical Methods for Engineers" McGraw-Hill, New York, 6th Edition. David M Potts and Lidija Zdravkovic. (1999). "Finite Element Analysis in Geotechnical Engineering – Theory", Thomas Telford Publishing Ltd., U.K.

6. Courses in Environmental Engineering

SN	Course Code	Course Name	Textbooks
1	CE 506	Environmental Chemistry	<ul style="list-style-type: none"> Vernon L. Snoeyink (1980) Water chemistry, New York: Wiley.
2	CE 508	Physicochemical Treatment Processes	<ul style="list-style-type: none"> Water Treatment: Principles and Design, 3rd ed., John Wiley & Sons.
3	CE 509	Biological Treatment Processes	<ul style="list-style-type: none"> Metcalf/Eddy: Wastewater Engineering: Treatment and Reuse, 4th edition, McGraw Hill, Boston, MA.
4	CE 543	Planning and Design of Water and Wastewater Networks	<ul style="list-style-type: none"> Water and Wastewater Systems Analysis, Volume 34, 1st Edition
5	CE 544	Environmental Air Pollution	<ul style="list-style-type: none"> C. David Cooper and F. C. Alley (2011) Air Pollution Control: A Design Approach, 4th edition: Waveland Press. Daniel A. Vallero (2014) Fundamentals of Air Pollution, 5th edition: Elsevier. Noel De Nevers (2017) Air Pollution Control Engineering, 3rd edition: Waveland Press.
6	CE 546	Solid Waste Management	<ul style="list-style-type: none"> Tchobanoglous G., Theisen H., Vigil S. A. " Integrated Solid Waste Management: Engineering Principles and Management Issues, McGraw-Hill (1993). Vesilind P. A. and Worrell W. A. "Solid Waste Engineering" (2015)
7	CE 547	Industrial and Hazardous Waste Management	<ul style="list-style-type: none"> Industrial Wastewater Management, Treatment and Disposal, WEF Manual of Practice No. FD-3, 3rd Edition, WEF Press and McGraw Hill, 2008. Geoenvironmental Engineering: Site Remediation, Waste Containment and Emerging Waste Management Technologies, Hari D. Sharma and Krishna R. Reddy, John Wiley and Sons, Inc., 2004. Bahadori, A. (2014). Waste management in the chemical and petroleum industries. West Sussex, United Kingdom: Wiley.

7. Courses in Transportation Engineering

SN	Course Code	Course Name	Textbooks
1	CE 531	Traffic Flow Characteristics	<ul style="list-style-type: none"> Traffic Flow Fundamentals: By A. D. May; Prentice Hall, 1990 (ISBN: 0139260722)
2	CE 532	Advanced Transportation Planning	<ul style="list-style-type: none"> Modelling Transport, 4th Edition, Juan de Dios Ortuzar, Luis G. Willumsen, ISBN: 978-0-470-76039-0 Black, J. (1981) Urban Transport Planning: Theory and Practice, (London: Croom Helm).

SN	Course Code	Course Name	Textbooks
			<ul style="list-style-type: none"> • Hensher, D.A. and Button, K.J. (2000) Handbook of Transport Modelling, Pergamon. • Taylor, MAP, Young, W and Bonsall, P (1996) Understanding Traffic Systems - Data, analysis and presentation, Avebury Technical, Ashgate, England. • Thomas, R. (1991) Traffic Assignment Techniques, Avebury Technical. • Transportation Research Board (1994) Highway Capacity Manual: Special Report 209. Third Edition (Washington, D.C.: Transportation Research Board, National Research Council).
3	CE 534	Traffic Flow Operation and Control	<ul style="list-style-type: none"> • Introduction to Traffic Flow Theory: An introduction with exercises, 1st Edition, by V.L. Knoop (2017) • Global Practices on Road Traffic Signal Control: Fixed-Time Control at Isolated Intersections, 1st Edition, by Keshuang Tang, Manfred Boltze, Hideki Nakamura, Zong Tian (2019) • Overseas Management of Traffic Congestion and Travel Demand (Traffic Infrastructure- Roads, Highways, Bridges, Airports and Mass Transit), by Jordana R. Salamone (2011)
4	CE 536	Advanced Geometric Design of Highways	<ul style="list-style-type: none"> • A Policy on Geometric Design of Highways and Streets, AASHTO, 6th Edition (2011) or later. • Roadside Design Guide, AASHTO, 4th Edition (2011) or later.
5	CE 537	Advanced Pavement Design	<ul style="list-style-type: none"> • A Policy on Geometric Design of Highways and Streets, AASHTO, 6th Edition (2011) or later. • Huang, Yang H., "Pavement Analysis and Design", Prentice-Hall, Inc. Englewood Cliffs, NJ, 2nd ed., 2010 • Rajib Mallik, Tahar ElKorchi, Pavement Engineering: Principles and Practice, 3rd Edition, 2017
6	CE 538	Pavement Evaluation and Maintenance	<ul style="list-style-type: none"> • "Modern Pavement Management", Haas, Hudson and Zaniewski.