

Better Education
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Department
of Civil



Undergraduate & Graduate
PROSPECTUS
National University - Sudan
5TH EDITION JULY 2024 - JUNE 2028

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National University - Sudan

Welcome

Welcome

Note from The President of NUSU

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01



This is the 5th Edition of the PROSPECTUS of the National University-Sudan (NUSU). In this document registered students will find information about the mission, vision and values of NUSU, and all programme details and activities. This edition includes both UNDERGRADUATE and GRADUATE course outlines. NUSU aims at high-class education in medical, technological and social sciences. This is reflected in this comprehensive outline. It describes the basis of NUSU's educational philosophies, programme objectives including the characteristics of the graduate, strategies and methods, degree structure, semester duration and credit hour load and brief outline of content. This represent a narrow window into the complex organization of NUSU. More information on rationale of modules, behavioural objectives, and assessment can be found in the curriculum of each Faculty. The calendars, year plans and timetables are issued for each semester with the exact dates for teaching sessions, other learning opportunities, assessment, feedback and holidays.

NUSU is now 19 years old. It is still developing, and trying to set traditions of availing all activities in its publications, that may remain relevant for 3-4 years, before new editions are issued. The councils and committees of NUSU, while compiling this, are drawing their experience from local and world-wide, up-to-date educational practices. Concurrently, other documents (Student

Manual, Staff Handbook, Induction packages, and policies and procedures) are re-written and updated, in view of the emerging concerns about student welfare, environment, students with special needs, and virtual online educational resources.

There is strong focus on synergy between modern education, developmental needs and employment market requirements. This has laid down a wide area of maneuvers in the choice of specific disciplines and modules. In each discipline, a detailed career advice has been added in this edition to show students the opportunities available if they chose to be employed or opt to start their own business to employ others.

The reputability of NUSU has attracted students from about 25 countries and all continents. This representation requires quality of premises and services, as well as understanding of diversity, inclusiveness and considerations for non-discrimination in the educational activities and campus life. International students and the Sudanese students whose families are living outside the Sudan, receive special induction, supervision and directives by the Deanship of Student Affairs, and regular courses shown in this prospectus as Sudanese Studies.

It is my pleasure to invite all qualified students to join NUSU's exciting new and innovative educational programmes. Students, parents and sponsors are welcome to visit the campus. They will receive guidance from the HELP DESK at the Main Gate. They will be escorted to buildings and connected with the leadership of the university or faculties. Our primary target is to create guest satisfaction. Your comments and feedback are important for us, to continue improvement to meet our goals.

Last, but not least, we would like to invite our higher education colleagues, inside and outside the Sudan, to read this publication. Our special request: please have a critical look at this and show us our faults. You may suggest means of correcting them, and tell others about the positive and bright spots of this attempt. Your advice will be highly appreciated.

Prof. Qurashi M. Ali PhD, MD, FRCPE
President, National University, Sudan

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02

World-wide, the overall innovations and their modifications stem out from the efforts of Professor Bashir Hamad. Every page of our documents could not be finalized, or brought to fruition, without his fatherly approval and comments or traces of his educational spirit. His direct and indirect contributions to the curriculum of this University and continuous encouragement are gratefully acknowledged, particularly those related to educational strategies, instruction and evaluation. The following have reviewed and reorganized the final versions of this prospectus: Prof. A/Rahman Eltom MD,PhD, Prof. A Rahman Biri MD FRCP, Prof. Elthami Abdul Mageed PhD, (medicine), Hassan M. Ali PhD, Dr. Ahmed Abusham PhD and Dr. Salah Ibrahim PhD, and Dr. Fatma Mukhtar MSc. (pharmacy), Dr. Kamal Khalil MD.Dr. Elfatih A Mageed MD (physiotherapy), Dr. M. A. Siddiq PhD. Prof. Awad Haj Ali PhD. (computer and health informatics program), Prof. Ibrahim Ghandor and Dr. Abdalla Darous, Dr. Enas Badawi PhD, Dr. Arif Affan (dentistry), Prof. Sayda H. Elsafi MD, PhD and Dr. Nihal Mirza MD, Dr. M. Sirelkhatim, Dr. M. Abdelgadir, Dr. Maha Magoub (medical laboratory sciences), Dr.Abdel Moneim Saeed PhD, Dr. M. A. Elsheikh PhD Dr. Elsir Ali Saeed PhD, Dr. M. Elfadil PhD (imaging technology), Prof. Awatif Ahmed PhD, and Ms. Fatma Bhruddin MSc, Dr. Sumia Ibrahim PhD (nursing and midwifery), Prof. Salih Faghiri PhD, Prof. Omer Elmagli PhD, and Prof. Hassan Kamal PhD, Dr. M. A. Osman, Dr. Mutaz Suliman, Dr. A Azim Almahal PhD, and Prof. A Gadir M. Ahmed PhD (management sciences). The contributions of Dr. Nadir Hasanain {Engineering} , Prof. A Latif Elboni and Dr. Ibrahim Mirghani (International Relations) are outstanding.The list, of those who, knowingly or unknowingly, contributed curricular details or ideas registered in Editor's memory or documents, is exhaustive. Our thanks are to the following professors: A/Hameed Lutfi, M.Y. Sukkar, Elbagir Ali El Faki, Amir El Mubarak, Omar Abdul Aziz, Othman Taha, Othman Khalafalla, Ali Habbour, Omar A. Mirghani, Awadseed Mustafa, Mubarak Majzoub, M. Awadalla Salih, Hafiz El Shazali, Jaafar M. Malik, Othman Hamour, Ali Karar, A/Alla A/Wahid, El Tayeb Abdul Rahman, Eisa Othman El Amin, Mamoun Homeida, Hassan M. Ahmed, Ali Abdul Rahman Barri, Ibrahim M. A/Rahim, Ahmed A. Muhamadani, Mukhtar El-Khatim, A/Rahman A/Hafeez, Sayed M. Ahmed, Awad A/Rahman El-Awad, M. Elamin El-Sharif, Kamal Zaki, A/Rahman El-Tom, Ghazi Salahuddin, Bakri Osman Saeed, Molyddin Majzoub, Jamal Suleiman, Abbas ElKarib, ElGamri ElRadi, Salah M. Omer, Majid Mustafa, Muzamil Hassan A/Qadir, M. A/Rahim A/AAI, Khalid Musa, Bakri Musa Abdul Karim, Tahir Othman Ali, Omar Siddiq, Fathel Rahman Ahmed Ali, A.Moneim Sahal, Omar Habbal, Mickell Seefldt, Ara Tekian, Margaret Uguroglu, Saleh A. Al Damegh, Zeinel Abdeen Karar, A/Rahman El-

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Most of the "Dentistry Curriculum" has been adapted, with permission, from experts all over the world, mainly deans and heads of departments in the Sudanese dental colleges, and institution in dental sciences. The outstanding effort of professors Ibrahim Ghandour, Yahya Eltayeb, Ibrahim Elkamil, Osman Elgindi, Ahmed Suliman, Abbas Ghariballa, Nadia A. Yahia, Elnur Ibrahim and improved by Enas Badawi, Eman Khair and Suha A/Gadir is gratefully acknowledged.

The Engineering curriculum has been designed by committees headed by Dr. Nadir Hasanain as dean and head of civil department, and valuable contributions by Prof. Seifeldin Sadig. The International Relations and diplomatic studies curriculum has been written first by Dr. Ibrahim Mirghani and has been edited and adapted to the national requirements by Prof. A Latif Albouni and Bakri A/Karim.

The whole idea could not have seen the light without the encouragement of the Investors' Corporation and Board of Trustees of the National University, who spend days every week responding to routine and emerging issues of financing. On their behalf I would like to thank the genius and friendly contribution of Mr. Zahir Twahry for his artistic preparation of the 3rd and 4th editions and other NUSU publications. The final editing of most of the undergraduate manuscript has been skillfully and patiently carried out by Prof. A Rahman Osman Beeri Former Secretary of Academic Affairs. The graduate prospectus has been compiled by Prof. M. M. A. Abulnur, Dean of Graduate Studies and Scientific Research, and Dr. M. Abd Al Kader and Dr. Hatem Al Rufaai.

WHAT IS THE NATIONAL UNIVERSITY?



1. MISSION, VISION AND VALUES

The **VISION** of the National University is to be a world-class leading provider of private higher education in the Sudan, in the aspects of elegance of environment and structures, excellence of curricula and learning strategies, quality of management systems, commitment of investors and employees to customer satisfaction (students, relatives and regulators), distinguished graduates in academic, general ethical standards, and concern with professionalism and original research production.

The **MISSION** is to: (1) constantly strive to provide efficient and best-in-class professionals, in their specialties (2) meet and exceed our customer needs and expectations, and (3) stay ahead of the competition by creating safe and rewarding workplace facilities and innovating new quality output, services and relationships in transparent, honest and fair business.

The **VALUES** are : (1) obligations to treat the public and one another with personal and professional integrity, consideration and mutual respect, (2) commitment to honesty, truthfulness, respect for human dignity, and professional ethical behaviour, (3) fair treatment of all citizens and employees, with no discrimination on the basis of morphology or ideology (4) promotion of democracy values, hard work, perseverance, commitment to success, accepting responsibility and accountability for one's conduct and obligations, and (5) creating and maintaining a respected reputation and positive image in the community as a trusted partner through excellent care of the individual and family, and responsibility towards the community and environmental problems and concerns.

2. DOCUMENTS

The legal documents of the University include: (1) the University Charter, (2) Academic Regulations (3) Rules of Activity and Conduct (4) Study Fees' Regulations, (5) Employment Regulations, (6) National Employment Penalty Regulations, (7) Contracts and Salary Scale, (8) Job Descriptions, (9) Staff Handbook, (10) Students' Manual, (11) Quality Manual, (12) Teaching, Learning and Assessment Policy, (12) Prospectus and Curricula, (13) Organizational Chart, (14) Committee Structure, (15) Log-books of students' skills and activities, (16) Year Plans, (17) Academic Calendars, (18) Programme Evaluation Forms, (20) Portfolio of Architectural and Structural Designs of Buildings, (21) External Examiners' Appointment, Reporting and Response documents and (22) numerous policies and procedures in areas of quality, safety, and non-discrimination.

3. BOARD OF TRUSTEES

The Board of Trustees (BOT) is formed according to the Charter to include the investors, the academicians, the representative of the Ministry of Higher Education, and public figures of interest in education or eminent in social accountability issues of universities. The current BOT is chaired by Dr. Taha Eltayeb A. Elimam, and includes in its membership: Prof. Qurashi M. Ali, Dr. Amin O. Sidahmed, Dr. M. Sirelkatim Ali, Prof. A-Rahman Osman Beeri, Prof. Osama A-rahman Elamin, Eng. M. Awadelkarim Elgasim, Dr. Saad Subahi, Dr. Elhadi Bakheet, Eng. Yousif A. Yousif, Prof. A-Moneim Algousi, Dr. Ismail Qurashi, Prof. Hassan M. Ali, Deans of faculties, and representatives appointed by the Ministry of Higher Education and approved by the President of the Sudan.

4. RIGHTS

4.1 GENDER RIGHTS

Throughout this manual (and the webpage) every effort has been made to use he/she, his/her, him /her. It may not be possible to assure that this fair use has been consistent. Any such unintended mistake should be taken to mean both sexes. Females have been addressed in situations of special concerns, in gender-specific issues, mainly out of respect for their specialized roles.

4.2 EXCLUSION OF LIABILITY AND DISCLAIMER

Throughout this manual (and the webpage) every effort has been made to ensure that expert, accurate and up-to-date guidance has been included. The administrative and academic authority continuously updates the NUSU data and academic regulations to satisfy the emerging needs, more quickly than publications would reflect. Approved changes are shown at the official notice-boards of the University. Accordingly, neither the Ministry of Higher Education, nor the NUSU administration, shall be liable to any person or entity with respect to any loss or damage caused or alleged to be caused by the information contained or omitted from this manual (or the webpage).

4.3 COPYRIGHTS

- a. The curriculum timetable and course details resemble many of those (or may contain parts) in other colleges in which the "President of NUSU" has been the main or essential member in the bodies responsible for curriculum design and evaluation. In many an institution he has been one of the driving forces for innovation. These institutions include: University of Gezira (Sudan), Sultan Qaboos University (Oman), Omdurman Islamic University, Alzaeim Al-Azhari University, University of Medical Science and Technology, African International University, National Ribat University, Al-Razi University (Sudan), and Al Qassim University (Saudi Arabia). Major innovations have been added to improve on the experience of the above institutions. This manual (and the webpage), in addition to comprehensive compilations in each program document (to be given to each student) is an entity of its own. Therefore, the total set of details, which is not available in any other institution so far, may not be

copied or published without written permission from the National University- Sudan.

- b. The teaching material available in the webpage, and other published material in the University notes, is original and should not be reproduced for commercial use, in any form without written permission of the National University- Sudan. Non-profitable teaching purposes are allowed. Our teachers and colleagues, who are mentioned in the “Acknowledgements”, are free to use this material because it is all from them, we could not single out what is ours from theirs.

5. ENRANCE REQUIREMENTS

- A. Applications must be through the Ministry of Higher Education (Sudan) Admission Directorate, based on passing a fresh Sudan (or equivalent) School Certificate or equivalent qualification (please see relevant booklets provided at that office). Older 5-10 years' School Certificates may be considered, if vacancies are there, and details are approved by the Admission Office. The newly introduced online application dismiss disqualified applicants automatically.
- B. Direct applications are welcome, but will be entered online by the University to the Admission Directorate for approval.
- C. International applications will be processed similarly, but candidates are advised to follow the application procedure in the webpage, and wait for a response, before arriving in the Sudan. The NUSU Administration takes 5 working days (after receipt of application) to finalize acceptance. Electronic communication is preferred. For security reasons. A student who is granted acceptance by the NUSU will NOT be allowed by the Ministry of Internal Affairs to transfer to any other university after arrival, except after studying and passing, at least, one academic year..
- D. Mature students qualified with a previous health science professional degree may be considered. In this case early application is recommended (6 months before national intake in September every year), because of the time it may take for the approval of the School Certificate by Ministries of General Education and Higher Education, Sudan.
- E. Final decision on acceptance depends on the results of an interview to confirm if the student has the aptitude to join a specialty, and is free from physical and psychological inabilities that are not compatible with the responsibilities of a specific or hardship profession. But individuals with special needs are welcome and will find NUSU a conducive environment of values against discrimination.
- F. Transfer NUSU from other universities may be considered for enrollment in Semesters 2, 3, 4 or 5 only, based on the approval of the General Directorate of Admission in the Ministry of Higher Education.

6. STAFF AND RECRUITMENT

Academic and administrative staff interested in joining the National University-Sudan, may show their intention by filling the e-recruitment form included in the webpage. A response will be sent

by e-mail within 48 hours, and further instructions will follow. Appointment of academic staff is based on academic excellence in the areas of research and teaching. Academic applicants with no research records or grants will not be considered for full-time positions in this university. Full- and part-time staff list may be looked up in [Academic Staff](#) section of the webpage.

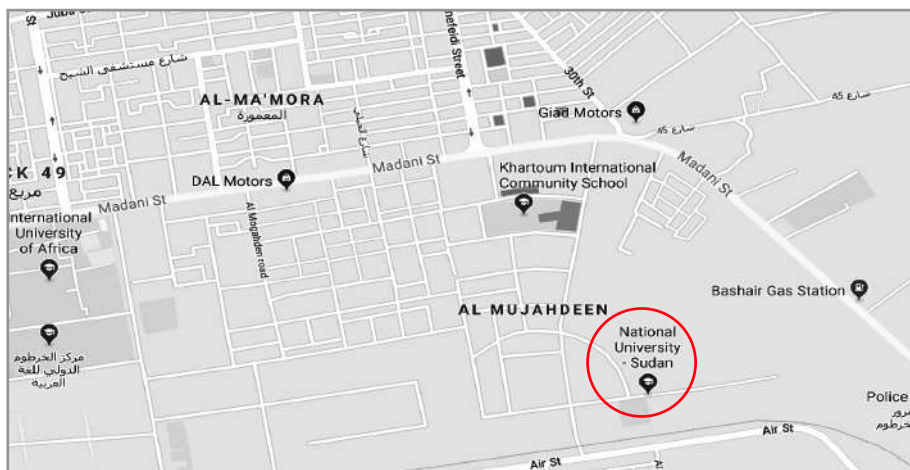
Applicants interested in joining other private educational institutions in the Sudan can reach them through our web-page. The [employment conditions](#) and [salary scale](#) are not (currently) available in this manual or website.

7. LOCATION AND MAPS

A. **The Country:** The best advantage of this National University is that it is located in the Sudan, an AfroArab country with rich human and natural life resources. The inhabitants are either Arabs or Africans.. The Sudan educational institutions are known, worldwide, for their academic excellence, ethical heritage and professional teaching perfection. A Sudanese national, wherever he/she may be is unique in considerateness, courtesy, and hospitality. In almost 80% of the country it is the safest in the world. A single lady can jog in Khartoum, or any other city, in the middle of the night unbothered. Sudanese abide voluntarily by strong moral codes and respect for females as foreigners. The media-nourished concepts of North-South or West-East conflicts have largely exaggerated the reality. The color of people has no significance in this country, may be the only country in the world where color has never and can never

be a real cause of conflict. Media are prototyping other countries' dilemmas on a local setup that has got some developmental problems. It is interesting that the Arabs in this country are mainly non-white, and the non-Arabs are not necessarily black, contrary to what the media have publicized. The luckiest person in the world, any moment, is the one who has been received by a Sudanese host.

B.



The City: The capital is Khartoum, a city made up of three cities striding the White Nile, Blue Nile as they join to form the River Nile. This has given it unique panoramic landscapes and scenery. There are about 4-6 million inhabitants, mostly in traditional houses, known for their spacious yards. Khartoum city is the official capital crowded with governmental offices, ministries, embassies and international organizations. There are some affluent districts where the price of a house may be as expensive as in New York or Tokyo, and other areas of modest housing. Therefore students have a wide range of choice. Transportation used to be a problem, now it is quite easy, but still, students are advised to find accommodation as near as possible to the University premises.

- C. Premises and Environment : (See map). The National University permanent building is located in the Eastern part of Khartoum called Al Raqi District, near the Khartoum-Medani Highway, in an affluent newly established residential area. This region has an interlacing and frequent network of transport, yet the wide roads give no impression of crowdedness, or noise pollution. This accessibility is an invaluable asset for an educational institution. The University block, a purpose-built structure, assumes a masterpiece of architectural innovation (see pictures). The National University is open for students and staff for 18 hours working days and 6 hours on weekends. The library, self-directed learning facilities are available for registered students and staff. Limited access to research laboratories is allowed for certain students who are involved in staff's research projects. Certain sport facilities (Basket- ball and volleyball) are within the premises. In-door recreational facilities are available in the Cafeteria. The source of proud of the University is the design of beautiful, environment-friendly and heavy duty facilities that serve its mission. Students and employees are expected to respect and work towards achieving that. Directives from them to their visitors are very important to maintain and improve the level of standards of perfection we intend to reach. There are few similar, or near, buildings of excellence of space and quality, so far, in higher education institutions in the Sudan.

A 10-floor building of the teaching hospital stands next the main University block and accommodates over 300 beds with all tertiary care facilities. A 5-floor building accommodate the Faculty of Engineering. NUSU owns a 35000 M2 area in Albagair Suburban Area, in which a new campus is being built. It includes a rural hospital.

8. PROGRAMME FEES

A list of tuition fees is published by the MHESR every year. Private institutions keep updating such list, but a student accepted in one particular academic year will NOT be charged with the fees published for fresh students. Fees cover teaching and administrative activities of the University including laboratories and in-campus training. Accommodation and food subsidies are NOT included. Transportation to and from the University or off-campus training sites is NOT included, but the University tries to provide that for selected activities. Additional fees are variable for compensations of absence or failure. Students pay for all courses Training outside the campus and examinations [substitute or supplementary], scheduled in the Summer or Holidays, based on the credit hour load of the courses. Fees for such compensations are usually not published in Academic Calendar, but requested by students or their sponsors.



VISION AND MISSION

The VISION of the Civil Engineering Department is to be recognized locally and regionally as a leading department providing high quality education, research and services.

The MISSION is to provide students with the highest level of theoretical and practical education that leads them to successful careers. The department programs prepare graduates to acquire effective and interactive skills to face new challenges as high caliber Civil Engineers to enable them to contribute effectively and professionally to society.

ENTRANCE REQUIREMENTS

A student interested in joining the Faculty of Engineering, has to:

1. Obtain pass mark in seven subjects including: Arabic language, religious studies, English language, mathematics, physics, chemistry, computer or engineering sciences. International students who have not studied Arabic and religious studies may have more alternative subjects from an approved list of subjects published in the webpage of Ministry of Higher Education.
2. Achieve the percentage in Sudan School Certificate announced every year (International students may have 10% less in the School Certificate scores.
3. Apply electronically through the website of the Admission and Accreditation Office, Ministry of Higher Education, or apply directly in Admission Office in the National University, and pass the health examination, aptitude tests and interview at the Faculty of Engineering-.
- 4- Pay the fees announced on the university website.

CAREER ADVICE :

Civil Engineering is the oldest and one of the most important branches of engineering profession all over the world as civil engineering is related to almost all aspects of civilization. Many of the important things in our lives that we take for granted are the product of civil engineering. Civil engineer deals with a wide variety of engineering aspects such as designing, construction, and maintenance of different structure (buildings, embankments, storage tanks, dams, roads, water and wastewater networks, irrigation and drainage networks, etc.), solving execution problems, managing engineering and construction projects, and it just does not end there. Civil engineer also has a significant role in planning and managing transportation systems, terrific safety, conservation and development of water resources, treatment and reuse of wastewater, and the list extends. The civil engineering curriculum in National University - Sudan is set to serve the broad range activities of the profession. It is designed to fulfill the student's need of sufficient and balanced content of different civil engineering topics. The graduate can go in any one of the above areas, and be immediately enrolled in jobs. A graduate may, also, choose to obtain masters or PhD in the subspecialties of civil engineering. International students are allowed to take engineering jobs in Sudan.

FACULTY OBJECTIVES

The objectives of the National University Faculty of Engineering -Civil Engineering Department are to:

1. Ensure that graduates will have a mastery of fundamental knowledge, problem solving skills, engineering experimental abilities, and design capabilities necessary for entering civil engineering career and/or higher studies.
2. Produce graduates that have the knowledge and skills necessary for identifying and assessing design alternatives and the related social, economic, environmental, and public safety impacts.
3. Produce graduates who have verbal and written communication skills necessary for successful professional practice.
4. Prepare graduates to function effectively on teams.
5. Prepare graduates to deal with ethical and professional issues, taking into account the broader societal implications of civil engineering.
6. Prepare graduates for professional careers, leadership roles and life-long learning.

Curriculum Objectives [Characteristics of the civil engineering graduate

A graduate of the National University Civil Engineering Curriculum should be able to:

1. Show ability to apply knowledge of mathematics, science, and engineering.
 2. Demonstrate the skills to design and conduct experiments, as well as to analyze and interpret data.
-

3. Show ability to design a system, component, or process to meet desired needs.
4. Present attitudes to function on multi-disciplinary teams.
5. Identify, formulate and solve engineering problems.
6. Show understanding of professional and ethical responsibility.
7. Communicate effectively.
8. Discuss the impact of engineering solutions in a global and societal context.
9. Recognize the need for, and an ability to engage in life-long learning
10. Show awareness of contemporary issues.
11. Use, skillfully the techniques, skills, and modern engineering tools necessary for engineering practice.
12. Plan, design, construct, maintain, and operate of large and permanent engineering projects of our civilization. Civil engineers are in demand wherever there are people.
13. Discuss the major subdivisions of civil engineering, structural, geotechnical, environmental, sanitary, water resources, and transportation engineering.
14. Outline the components of projects as bridges and large buildings, dams, and other river and harbor work, municipal water supply and sanitation facilities, streets, highways, and other transportation facilities.

Feedback to students after mid-course and end of course assessment is an essential part of the civil engineering programme

PLAN TIMETABLE

The student has to earn 186 credit hours to obtain a B.Sc. degree in Civil engineering. The study program distributed over 10 semesters as follows:

Semester 1 [22 CHs - 18 weeks]

| Course Title | Code | Contact Hours | | | | CH |
|-----------------------------------|---------------|---------------|----------|-----|----------|----------|
| | | Th. | Tut | Lab | Total | |
| Physics I | PHY111 | 2 | 1 | 2 | 5 | 3 |
| Chemistry | CHM 111 | 2 | | 3 | 5 | 3 |
| Calculus I | MAT111 | 2 | 2 | | 4 | 3 |
| Linear Algebra | MAT 112 | 2 | 2 | - | 4 | 3 |
| Engineering Mechanics I (Statics) | MAT 113 | 2 | 2 | | 4 | 3 |
| English Language I | ENL111 | 3 | - | - | 3 | 3 |
| Engineering Drawing I | GEN 121 | 1 | 3 | | 4 | 2 |
| Sudanese Culture | SCL111 | 2 | - | - | 2 | 2 |
| | | 16 | 10 | 5 | 31 | 22 |

Semester 2 [21 CHs - 18 weeks]

| Course Title | Code | Contact Hours | | | | CH |
|-------------------------------------|---------|---------------|-----|-----|-------|----|
| | | Th. | Tut | Lab | Total | |
| Physics II | PHY 121 | 2 | 1 | 2 | 5 | 3 |
| Calculus II | MAT 121 | 2 | 2 | - | 4 | 3 |
| Analytic Geometry | MAT 122 | 2 | 2 | - | 4 | 3 |
| Engineering Mechanics II (Dynamics) | MAT 123 | 2 | 2 | - | 4 | 3 |
| Introduction to Computer | COM121 | 1 | - | 2 | 3 | 2 |
| English Language II | ENL121 | 2 | 2 | - | 4 | 3 |
| Engineering Drawing II | GEN121 | 1 | 3 | | 4 | 2 |
| Fundamental of Engineering | GEN122 | 2 | - | - | 2 | 2 |
| | | 14 | 12 | 4 | 30 | 21 |

Semester 3 [20 CHs- 18 weeks]

| Course Title | Code | Contact Hours | | | | CH |
|-----------------------------------|---------|---------------|-----|-----|-------|----|
| | | Th. | Tut | Lab | Total | |
| Technical English for Engineering | ENL 211 | 2 | 2 | | 4 | 3 |
| Engineering Geology | CEN 213 | 3 | | | 3 | 3 |
| Differential Equations | MAT 211 | 2 | 2 | | 4 | 3 |
| Computer Programming | COM 221 | 2 | | 3 | 5 | 3 |
| Mechanics of Materials I | GEN 212 | 2 | 2 | | 4 | 3 |
| Introduction to Civil Engineering | CEN 211 | 2 | - | | 2 | 2 |
| Surveying | CEN 212 | 2 | | 3 | 5 | 3 |
| | | 15 | 6 | 6 | 27 | 20 |

Semester 4 [20 CHs- 18 weeks]

| Course Title | Code | Contact Hours | | | | CH |
|--|---------|---------------|-----|-----|-------|----|
| | | Th. | Tut | Lab | Total | |
| Numerical Methods | MAT 222 | 2 | 2 | 1 | 5 | 3 |
| Vector Analysis | MAT 221 | 2 | 2 | | 4 | 3 |
| Introduction to Mechanical Engineering | GEN 221 | 2 | 1 | | 3 | 2 |
| Advance Surveying | CEN 221 | 2 | | 3 | 5 | 3 |
| Civil Engineering Drawing | CEN222 | 1 | 3 | | 4 | 2 |
| Material science | GEN 223 | 2 | - | | 2 | 2 |
| Occupational and Environmental Safety | GEN 222 | 2 | | | 2 | 2 |
| Introduction to Electrical Engineering | GEN 224 | 2 | 1 | 2 | 5 | 3 |
| | | 15 | 9 | 6 | 30 | 20 |

Semester 5 [19 CHs- 18 weeks]

| Course Title | Code | Contact Hours | | | | CH |
|---------------------------------|---------|---------------|-----|-----|-------|----|
| | | Th. | Tut | Lab | Total | |
| Complex Functions | MAT 311 | 2 | 2 | - | 4 | 3 |
| Structural Analysis I | CEN 311 | 2 | 2 | | 4 | 3 |
| Fluid Mechanics | CEN 312 | 2 | 1 | 2 | 5 | 3 |
| Concrete Technology | CEN 313 | 2 | - | 3 | 5 | 3 |
| Construction Engineering | CEN 314 | 2 | - | - | 2 | 2 |
| Mechanics of Materials II | CEN 315 | 2 | 2 | - | 4 | 3 |
| Engineering Properties of Soils | CEN 316 | 2 | - | 1 | 3 | 2 |
| | | 14 | 7 | 6 | 27 | 19 |

Semester 6 [16 CHs- 18 weeks]

| Course Title | Code | Contact Hours | | | | CH |
|--------------------------------|---------|---------------|-----|-----|-------|----|
| | | Th. | Tut | Lab | Total | |
| Ethics and Profession practice | CEN 325 | 2 | - | - | 2 | 2 |
| Hydraulics | CEN 322 | 2 | 1 | 2 | 5 | 3 |
| Remote Sensing and GIS | CEN 321 | 3 | - | 1 | 4 | 3 |
| Statistics and Probability | MAT 321 | 2 | 2 | 1 | 5 | 3 |
| Quantity Surveying | CEN 323 | 2 | 1 | - | 3 | 2 |
| Reinforced Concrete Design I | CEN 324 | 2 | 2 | - | 4 | 3 |
| | | 13 | 6 | 4 | 23 | 16 |

Surveying camp 2 Weeks 120 Hoursequivalent to 8 practical hours.

Semester 7 [18 CHs- 18 weeks]

| Course Title | Code | Contact Hours | | | | CH |
|----------------------------|---------|---------------|-----|-----|-------|----|
| | | Th. | Tut | Lab | Total | |
| Water Supply Engineering | CEN 411 | 2 | 1 | 2 | 5 | 3 |
| Structural Analysis II | CEN 412 | 2 | 2 | | 4 | 3 |
| Hydrology | CEN 413 | 3 | 1 | | 4 | 3 |
| Design of Steel Structures | CEN 414 | 2 | 2 | | 4 | 3 |
| Soil Mechanics | CEN 415 | 2 | 1 | 2 | 5 | 3 |
| Engineering Economics | GEN 411 | 2 | 2 | | 4 | 3 |
| | | 13 | 9 | 4 | 26 | 18 |

Semester 8 [17 CHs- 18 weeks]

| Course Title | Code | Contact Hours | | | | CH |
|-------------------------------|---------|---------------|-----|-----|-------|----|
| | | Th. | Tut | Lab | Total | |
| Reinforced Concrete Design II | CEN 421 | 2 | 2 | | 4 | 3 |
| Waste Water Engineering | CEN 422 | 3 | 1 | | 4 | 3 |
| Highway and Transportation | CEN 423 | 2 | 1 | 3 | 6 | 3 |
| Groundwater Engineering | CEN 424 | 2 | 1 | | 3 | 2 |
| Structural Analysis III | CEN 425 | 3 | 1 | | 4 | 3 |
| Construction Management | CEN 426 | 2 | 2 | | 4 | 3 |
| | | 14 | 8 | 3 | 25 | 17 |

Semester 9 [15 CHs- 18 weeks]

| Course Title | Code | Contact Hours | | | | CH |
|---------------------------------|---------|---------------|-----|-----|-------|----|
| | | Th. | Tut | Lab | Total | |
| Foundation Engineering | CEN 511 | 3 | 1 | | 4 | 3 |
| Highway construction and Design | CEN 512 | 3 | 1 | | 4 | 3 |
| Dynamics of Structures | CEN 513 | 3 | 1 | | 4 | 3 |
| Hydraulic Structures | CEN 514 | 3 | 1 | | 4 | 3 |
| Elective 1 | CEN 52 | 3 | 1 | | 4 | 3 |
| Graduation Project | CEN 590 | | 6 | | 6 | - |
| | | 15 | 11 | 0 | 26 | 15 |

Semester 10 [15 CHs- 18 weeks]

| Course Title | Code | Contact Hours | | | | CH |
|---------------------------------------|---------|---------------|-----|-----|-------|----|
| | | Th. | Tut | Lab | Total | |
| Improvement of Geotechnical Materials | CEN 521 | 3 | - | - | 3 | 3 |
| Computer Applications | CEN 522 | 2 | - | 3 | 5 | 3 |
| Bridge Design | CEN 523 | 3 | 1 | - | 4 | 3 |
| Elective 2 | CEN 52 | 3 | 1 | - | 4 | 3 |
| Graduation Project | CEN 590 | 0 | 12 | - | 12 | 6 |
| | | 11 | 14 | 3 | 28 | 15 |

COURSE OUTLINES:

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--------------|-------------|--------------------------|----------------|
| PHYSICS I | PHY 111 | 1/Longitudinal | 2,1,2 |

Vectors, particle kinematics and dynamics, work, energy, momentum, angular momentum, conservation laws, rigid bodies, oscillations, temperature, properties of matter. Mechanisms of heat transfer, introduction to kinetic theory of matter. Physical optics: theories of light; diffraction of light; polarization; Waves and oscillations.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--------------|-------------|--------------------------|----------------|
| CALCULUS I | MAT111 | 1/Longitudinal | 2,2,0 |

Functions, limits, continuity, differentiation and integration of polynomials, exponential, logarithmic and trigonometric functions, product, quotient and chain rules applications of differentiation to graphing, series, maximum-minimum problems and related rate problems, definite and indefinite integrals, and the fundamental theorem of calculus. Surfaces of revolution, parametric equations, polar coordinates, sequences and series, and Taylor series.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--------------|-------------|--------------------------|----------------|
| PHYSICS II | PHY121 | 2/Longitudinal | 3,1,2 |

Electricity and magnetism: Coulomb's law, Gauss's law and its application, Ohm's law, Kirchoff's law; Faradays law of electromagnetic induction, Modern physics: Galilean transformation, special theory of relativity and its consequences; quantum theory of radiation; photo-electric effect, Compton effect, wave particle duality, interpretation of Bohr's postulates, radioactive disintegration, properties of nucleus, nuclear reactions, fission, fusion, chain reaction, nuclear reactor.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-------------------|-------------|--------------------------|----------------|
| GENERAL CHEMISTRY | CHM 111 | 2/Longitudinal | 2,0,3 |

Atomic law, quantum mechanics and Bohor hydrogen atom, wave mechanics atomic model, periodic table, periodic properties of elements and its relation to electronic structure, chemical and physical bonding: types and properties, electronic bonding and particle structure, bonding forces; Spectroscopy.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|----------------|-------------|--------------------------|----------------|
| Linear Algebra | MAT 112 | 2/Longitudinal | 2,2,0 |

Geometric vectors in three dimensions, dot product, cross product, lines and planes, complex numbers, systems of linear equations, existence and nonexistence of solutions, matrix algebra: matrix inverse, determinants, Cramer's rule, introduction to vector spaces, linear independence and bases, rank, linear transformations, matrix- matrix Transformation: rotation of sxes, orthogonality and applications, Gram-Schmidt algorithm, Eigen values and eigenvectors.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--------------|-------------|--------------------------|----------------|
| Calculus II | MAT 121 | 2/Longitudinal | 2,2,0 |

Applications of integration including areas, volumes, moments, pressure and work, techniques of integration, length of curves, surfaces of revolution, parametric equations, functions of several variables, partial derivatives, implicit functions, multiple integrals, line, surface, and volume integrals, change of variables in multiple integrals .Polar coordinates: polar curves, standard polar curves

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-------------------|-------------|--------------------------|----------------|
| Analytic Geometry | MAT 122 | 2/Longitudinal | 2,2,0 |

Introduction Coordinates. Vector form of a straight line, parametric equations of a straight line, Planes: Equation of a plane, Cylindrical and spherical coordinate: Introduction to cylindrical and spherical Coordinates, Surfaces: Quadratic surfaces, Cylinder and cone: Cylinder, directrix of cylinder, right cylinder, The conic sections, General equation of sphere, great circle.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--|-------------|--------------------------|----------------|
| Engineering Mechanics I (Statics) | MAT 113 | 2/Longitudinal | 2,2,0 |

Vector operations. Equilibrium of a particle. Free body diagram. Moment of forces about a point and about an axis. Equivalent systems. Equilibrium of a rigid body in two dimensions. Trusses (method of Joints and sections) .Bullys. Friction.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--|-------------|--------------------------|----------------|
| Engineering Mechanics II (Dynamics) | MAT 123 | 2/Longitudinal | 2,2,0 |

Displacement, velocity and acceleration (and their angular counterparts) - basic dynamics concepts – force, momentum, work and energy - Newton’s laws of motion - basic dynamics concepts - the Work-Energy principle, Impulse-Momentum principle.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|------------------------|-------------|--------------------------|----------------|
| DIFFERENTIAL EQUATIONS | MAT 211 | 3/Longitudinal | 2,2,0 |

Ordinary differential equation: formation of differential equations; solution of first order differential equations by various methods; solution of differential equation of first order but higher degrees; solution of general linear equations of second and higher orders with constant co-efficient; solution of Euler’s homogeneous linear differential equations.

Partial differential equation: introduction, linear and non-linear first order differential equations; standard forms; linear equations of higher order; equations of the second order with variable coefficients.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-----------------------------------|-------------|--------------------------|----------------|
| INTRODUCTION TO CIVIL ENGINEERING | CEN 211 | 3/Longitudinal | 2,0,0 |

Civil engineering profession. Civil engineering disciplines. Infrastructures. Building Constructions and management. Remote sensing & GIS. Environmental Engineering. Road Engineering. Bridges. Dams and Irrigation. Site visits.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-------------------------|-------------|--------------------------|----------------|
| MECHANICS OF MATERIAL 1 | GEN 213 | 3/Longitudinal | 2,2,0 |

Concepts of stress and strain, constitutive relationships; deformations due to tension, compression

and temperature change; beam statics: reactions, axial force, shear force and bending moments; axial force, shear force and bending moment diagrams using method of section and summation approach; elastic analysis of circular shafts, solid noncircular and thin walled tubular members subjected to torsion; flexural and shear stresses in beams; shear centre; thin walled pressure vessels. Tension, direct shear and impact tests of mild steel specimen

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|---------------------|-------------|--------------------------|----------------|
| ENGINEERING DRAWING | GEN211 | 3/Longitudinal | 1,3,0 |

Lines and lettering; plane geometry: drawing of linear and curved geometric figures, e.g. pentagon, hexagon, octagon, ellipse, parabola, hyperbola; solid geometry: concept of isometric view and oblique view, theory of projections; drawing of isometric view of 3d objects such as cube, prism, pyramid, cone and cylinder; projections of cube, prism, cone, cylinder; developments

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|----------------------|-------------|--------------------------|----------------|
| COMPUTER PROGRAMMING | COM 221 | 3/Longitudinal | 2,0,2 |

Computer organization and hierarchy of programming language, high-level language, arithmetic computations, algorithm design Flowcharts, selection statements, repetition statements, debugging and testing of programmed, logical and character data type, data files and formatted outputs, array processing, Applications.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|---------------------|-------------|--------------------------|----------------|
| ENGINEERING GEOLOGY | CEN 213 | 3/Longitudinal | 2,0,0 |

Introduction. Process of external and internal origin (Volcanic, Metamorphic, Sedimentary), Physical properties and identification of common rock forming minerals, Weathering and Erosion, Discontinuity classification: Joints, faults and other fractures, Folds, unconformities.

Brief Introduction to structural Geology: Seismic Waves, Classification of Earthquakes, Earthquake Geology of Aquifers, Wells, Springs and Ground Water Conditions, Role of geology in selection of sites for civil engineering structures, Brief introduction of local geology

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--------------|-------------|--------------------------|----------------|
| SURVEYING | CEN 212 | 3/Longitudinal | 2,0,3 |

Distance measurement techniques, Leveling and Contouring: Reduction of levels, adjustments of levels, precise leveling. Theodolite and its Types, Traversing and Triangulation, Tachometry, Plane Table Surveying. Horizontal control techniques. Survey markers, Observations on Polaris, Computation technique for azimuth determination and Gyro-theodolite. Total Stations.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-------------------|-------------|--------------------------|----------------|
| NUMERICAL METHODS | MAT221 | 4/Longitudinal | 2,2,0 |

Errors and Approximation. Bisection method, Newton's method, Secant method, Method of false position. Newton's and Gauss interpolating techniques, Simple theorems on divided differences, Lagrange's formula of interpolation, Numerical differentiation. Numerical Integration: Trapezoidal and Simson's rule numerical integration techniques. Solution of differential equations, Euler and modified Euler methods, RungeKutta and KuttaMerson methods..

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-----------------|-------------|--------------------------|----------------|
| VECTOR ANALYSIS | MAT 222 | 4/Longitudinal | 2,2,0 |

Vectors: addition, subtraction, multiplications, vectors products. space curves, arc length, curvature, scalar and vector fields, gradient, divergence and curl. Theorem: the divergence Theorem, Green's theorem in a Plane, Stokes' theorem. Derivation of Gauss's Law, the Heat equation and Navier-Stokes equations.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|---------------------------|-------------|--------------------------|----------------|
| CIVIL ENGINEERING DRAWING | CEN 221 | 4/Longitudinal | 1,3,0 |

An introduction in graphical engineering which cover graphical technique and technical drawing principle in order preparing civil engineering drawing. Computer usage in drawing and detailing, Basic CAD practices, Basic AutoCAD usage.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--|-------------|--------------------------|----------------|
| INTRODUCTION TO MECHANICAL ENGINEERING | GEN 221 | 4/Longitudinal | 2,1,2 |

Basic Concepts: Fundamentals of Heat Transfer, Conduction, Convection, Radiation, Thermal Conductivity, Overall Heat Transfer Coefficients, Practical Equations, Laws of Thermodynamics, Internal Combustion Engines. Heating Ventilation and Air Conditioning (HVAC): Introduction to HVAC components. Heating and cooling load and its calculations; Comfort charts; Outline of A.C. systems; Consideration for air-conditioning in buildings; natural Ventilations; Insulating materials.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--|-------------|--------------------------|----------------|
| INTRODUCTION TO ELECTRICAL ENGINEERING | GEN 222 | 4/Longitudinal | 2,1,2 |

Electrical Elements and Circuits: Electric current, voltage, power and energy, Ohm's law, inductance, capacitance, Kirchoff's laws. Introduction to node voltage and loop current methods, AC single and poly-phase system, DC machines, AC Synchronous Machines, AC Induction Machines, Transformers, Converting Machines. Power Plant Installations and Distribution System: Power Systems layout, generation, transmission, distribution and utilization of electric power, Introduction to domestic elec-

trification. Electronics: Diode. Transistor and simple rectifier circuit. Principles of House wiring and Industrial wiring, Illumination. Electrical know how related to experimental design instrumentations like corrosion rate measurements, strain gauges, LDT's, LVDT's. etc.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|------------------|-------------|--------------------------|----------------|
| Material Science | GEN 223 | 4/Longitudinal | 2,0,0 |

Classification of materials. Atomic structure: atomic structure and Inter-atomic bonding,, ceramics and polymers. Imperfections in solids. Mechanical properties of materials: Response to Stress, Shear and Torsion. Phase diagrams and transformation in metals. Metal Alloys, Ceramics, and Polymers. Corrosion and degradation of materials. Electrical, Optical ,thermal and magnetic properties: Material selection and design considerations. Economical, environmental and social issues in materials science.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|---------------------------------------|-------------|--------------------------|----------------|
| Occupational and Environmental Safety | GEN 224 | 4/Longitudinal | 2,0,0 |

Methods of toxicology and risk assessment of workplace, hazards, contemporary issues on chemical hazards in the workplace, physical hazards in the workplace, ergonomics, occupational epidemiology, and national, regional and international guidelines, standards and regulations.

Environmental hazards, indoor air quality, ambient air quality, water pollution, solid waste disposal and mining pollution, environmental noise, environmental auditing and impact assessments

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--------------------|-------------|--------------------------|----------------|
| Advanced Surveying | CEN 221 | 4/Longitudinal | 2,0,3 |

Control Surveys: Geodesy, Coordinate Systems and Datum, Modern Methods in Surveying. Computation of areas by various methods, Computation of and volumes by various methods. Height of points from a Digital Terrain Model. Mass-Hall Diagram. Horizontal and vertical curves.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-----------------------|-------------|--------------------------|----------------|
| STRUCTURAL ANALYSIS I | CEN 311 | 5/Longitudinal | 2,2,0 |

Basic principles. Analysis of statically determinate trusses, beams, frames, arches, suspension cables. Influence lines for statically determinate structures. Deflection of structures. Buckling of columns.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|---|-------------|--------------------------|----------------|
| ENGINEERING PROPERTIES OF SOIL & MEASUREMENTS | CEN 316 | 5/Longitudinal | 2,0,1 |

Laboratory Measurements of: Moisture density relationship, Classification and identification of soil, Grain size analysis, Compaction characteristics, Permeability, Consolidation, Shear strength. Associated laboratory experiments.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--------------------------|-------------|--------------------------|----------------|
| CONSTRUCTION ENGINEERING | CEN 314 | 5/Longitudinal | 2,0,0 |

General, Construction Environment. Site work, construction equipment, Substructure, Superstructure, Internal Construction and finishing, Domestic Services.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|---------------------|-------------|--------------------------|----------------|
| CONCRETE TECHNOLOGY | CEN 313 | 5/Longitudinal | 2,0,3 |

Introduction to concrete; component materials for concrete (cement, aggregates, water, chemical admixtures, mineral admixtures); properties of materials, tests on materials; production processes of concrete, tests on fresh concrete; concrete mix design; tests on hardened concrete, properties of hardened concrete, strength, deformation, durability.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-----------------|-------------|--------------------------|----------------|
| FLUID MECHANICS | CEN 312 | 5/Longitudinal | 2,1,2 |

Introduction to fluid properties and characteristics, static fluid, fluid kinematics, continuity equation, momentum equation and, Bernoulli and energy equation, flow measurement, boundary layers, lift and drag forces. Related laboratory experiments.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--------------------------|-------------|--------------------------|----------------|
| MECHANICS OF MATERIAL II | CEN 315 | 5/Longitudinal | 2,2,0 |

Symmetric and unsymmetric bending of beams; stress transformation, failure criteria; beam deflection by direct integration and moment area method; buckling of columns; elastic strain energy and external work; cable and cable supported structures; bolted, riveted and welded joints.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|------------------------------|-------------|--------------------------|----------------|
| REINFORCED CONCRETE DESIGN I | CEN 324 | 6/Longitudinal | 2,2,0 |

Introduction to properties of concrete and reinforcing steel. Behaviour of reinforced concrete under flexure and shear. Introduction to Code of Design. Types of loads and their factors. Ultimate strength method of design. Analysis and design of singly and doubly reinforced sections. Analysis and design of T-section. Design of beams against shear forces. Design of one-way slab and stairways. Development length. Design of isolated, combined and wall footings.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--------------|-------------|--------------------------|----------------|
| HYDRAULICS | CEN 322 | 6/Longitudinal | 2,1,2 |

Pipe flow analysis and design. Steady flow in closed conduits and networks. Steady uniform flow in open channels. Non-uniform flows in open channels. Flow measurements. Hydraulic machinery (Pumps and Turbines), Related laboratory experiments.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|----------------------------|-------------|--------------------------|----------------|
| Statistics and Probability | MAT 322 | 6/Longitudinal | 2,2,0 |

measures of central tendency and standard deviation; moments, skewness and kurtosis; elementary probability theory and discontinuous probability distribution; continuous probability distributions, e.g. normal and exponential distribution.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|------------------------|-------------|--------------------------|----------------|
| REMOTE SENSING AND GIS | CEN 321 | 6/Longitudinal | 3,0,1 |

Introduction to the basic for GPS and GIS applications; Geodesy: introduction, the ellipsoid and geoids, geodetic position, geoids undulation, deflection of the vertical, geodetic coordinate system; Map Projection: projections used in state plane coordinate systems, UTM projection; GPS: overview of GPS, differential GPS, GPS static survey, GPS kinematic survey; GIS: introduction to GIS, GIS data sources and data format, creating GIS databases, GIS applications, use of surveying software such as GeoMedia and Leica Geo Office). Surveying camp 2 Weeks. 120 Hours equivalent to 8 practical hours.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--------------------|-------------|--------------------------|----------------|
| QUANTITY SURVEYING | CEN 323 | 6/Longitudinal | 2,1,0 |

Specification of construction items. Bill of Quantities (B.O.Q) & Measurement Book (M.B): Types and methods of estimates, Working out quantities, rates and cost. schedule of rates and specifications; Rate analysis;

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|------------------------|-------------|--------------------------|----------------|
| STRUCTURAL ANALYSIS II | CEN 412 | 7/Longitudinal | 2,2,0 |

Analysis of statically indeterminate structures by method of consistent deformations. Method of slope-deflection and moment distribution. Influence lines for statically indeterminate structures. Approximate methods of analyze of multi-sections forms.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|----------------------------------|-------------|--------------------------|----------------|
| Ethics and Professional Practice | CEN 427 | 7/Longitudinal | 2,0,0 |

Engineering ethics: meaning of ethics, importance of ethics, principles of ethics, required ethical behaviour, code of engineering ethics, responsibilities of professional engineer, professional behaviour. Basics of law for engineers: introduction to Sudanese legal system, law of contract, industrial law, intellectual property law .etc.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|----------------|-------------|--------------------------|----------------|
| SOIL MECHANICS | CEN 415 | 7/Longitudinal | 2,1,2 |

Seepage theory, soil stresses using elastic theory, Immediate settlement, Total and effective stress principle, consolidation settlement and its rate, Shear strength, Lateral earth pressure, Slope stability, Excavation and bracing. . Associated laboratory experiments.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-----------------------|-------------|--------------------------|----------------|
| ENGINEERING ECONOMICS | GEN 411 | 7/Longitudinal | 2,0,0 |

Economics and engineering; microeconomics and macroeconomics; theory of demand and supply and their elasticity; demand estimation; price determination; depreciation; Time value of money; cost-benefit analysis; pay-back period, NPV, IRR, inflation; economic feasibility of engineering undertakings.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--------------|-------------|--------------------------|----------------|
| HYDROLOGY | CEN 413 | 7/Longitudinal | 3,1,0 |

Principles of Hydrology and Water Resources Engineering. Hydrologic cycle. Measurement of precipitation, evaporation, infiltration and stream flows. Hydrographs. Flood Routing. Reservoir Sedimentation.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|----------------------------|-------------|--------------------------|----------------|
| DESIGN OF STEEL STRUCTURES | CEN 414 | 7/Longitudinal | 2,2,0 |

Design of steel structures. Material properties of steel. Allowable stress design approach. Introduction to codes. Connections, tension members, compression members, beam-columns. Beams and girders. Design of frames, trusses and industrial buildings.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--------------------------|-------------|--------------------------|----------------|
| Water Supply Engineering | CEN 411 | 7/Longitudinal | 2,2,0 |

Sources of water and demand requirements, Water quality parameters, Water treatment operations, Water distribution networks, Laboratory Experiments

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-------------------------------|-------------|--------------------------|----------------|
| REINFORCED CONCRETE DESIGN II | CEN 421 | 8/Longitudinal | 2,2,0 |

Review ACI/Euro- Code provisions. Design of Continuous Beams and Frames: Continuity of reinforced concrete structures, load combinations. Design of Two-way slabs: Edge supported vs. column supported slab systems. Design of rectangular and circular Reinforced Concrete Columns. Axially and eccentrically loaded columns. interaction diagrams. Slender columns and biaxial bending.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|----------------------------|-------------|--------------------------|----------------|
| TRANSPORTATION ENGINEERING | CEN 423 | 8/Longitudinal | 3,1,2 |

Transportation as a system; human and vehicle characteristics; traffic flow characteristics; highway capacity analysis; highway control devices; public transportation; urban transportation planning; parking facilities; transportation safety; intelligent transportation system and computer applications; introduction to railway, waterway, airport and pipeline.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|------------------------|-------------|--------------------------|----------------|
| WASTEWATER ENGINEERING | CEN 422 | 8/Longitudinal | 3,1,0 |

Composition of sewage and solid wastes, characterization of sewage, B.O.D. Removal kinetic, Sanitation in developing countries, Wastewater collection: Sanitary sewers systems, Storm water collection, Preliminary, primary and secondary treatment, tertiary & advanced treatment, sludge management and waste stabilization ponds system, Introduction to industrial wastes.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-------------------------|-------------|--------------------------|----------------|
| STRUCTURAL ANALYSIS III | CEN 425 | 8/Longitudinal | 3,1,0 |

Energy methods. Matrix method of structural analysis. Flexibility and stiffness methods. Elastic instability. Limit state analysis of frames.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--------------------------|-------------|--------------------------|----------------|
| GROUND WATER ENGINEERING | CEN 424 | 8/Longitudinal | 2,1,0 |

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

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-------------------------|-------------|--------------------------|----------------|
| CONSTRUCTION MANAGEMENT | CEN 426 | 8/Longitudinal | 3,1,0 |

Construction planning, scheduling, and control. Use of computer-based information systems for project management. Value engineering. Critical path method and PERT scheduling techniques. Computer drawn scheduling networks. Schedule compression. Resource allocation leveling and optimization. Project organization and financial control. Decision making.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|------------------------|-------------|--------------------------|----------------|
| FOUNDATION ENGINEERING | CEN 511 | 8/Longitudinal | 3,1,0 |

Application of soil mechanics and other related techniques to design of foundations. Methods of site and soil exploration; bearing capacity and settlements; shallow and deep foundations; bracing and retaining structures. Case studies

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|---------------------------------|-------------|--------------------------|----------------|
| HIGHWAY DESIGN AND CONSTRUCTION | CEN 512 | 9/Longitudinal | 3,1,0 |

Characteristics of driver, pedestrian vehicle, and traffic flow affecting highway design; Geometric design of highways; Layouts of intersections, interchanges and terminals; Highway drainage; Review of highway paving materials; Design of asphalt paving mixtures; Pavement design; Highway construction and supervision; categorization of common pavement surface distress and associated correction activities; Introduction to maintenance management system;

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-----------------------|-------------|--------------------------|----------------|
| DYNAMICS OF STRUCTURE | CEN 513 | 9/Longitudinal | 3,1,0 |

Single degree of freedom system, formulation of equation of motion; free vibration response; response to harmonic, impulse and general dynamic loading; vibration analysis by Rayleigh's method; response spectra; two degrees of freedom system.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|----------------------|-------------|--------------------------|----------------|
| HYDRAULIC STRUCTURES | CEN 514 | 9/Longitudinal | 3,1,0 |

Types and functions of hydraulic structures. Gravity Dams. Earth dams. Over weirs and spillways. Energy dissipation hydraulic structures. Hydropower Plants. Hydraulic design of culverts.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--------------------------------|-------------|--------------------------|----------------|
| ELECTIVE I: FROM CE DEPARTMENT | CEN 55- | 9/Longitudinal | 3,1,0 |

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|----------------------|-------------|--------------------------|----------------|
| GRADUATION PROJECT I | CEN 590 | 9/Longitudinal | 0,3,0 |

This is the first phase of the capstone project that is a continual project over two semesters, and involves number of students working as one team tackling different aspects of the civil engineering works, which may involve research and development work, engineering design, literature survey, experimental work, theoretical work, computational studies, simulation, and implementation. Students

will be assigned an research and development project, and all work conducted during the semester must be compiled in a final report and orally presented to the examining committee at the end of Semester 2.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|---------------------------------------|-------------|--------------------------|----------------|
| IMPROVEMENT OF GEOTECHNICAL MATERIALS | CEN 521 | 10/Longitudinal | 3,0,0 |

Improving performance of soils for engineering applications. Analysis of methods of stabilizing soils and rocks including topics on: Mechanical and chemical stabilization and earth reinforcement. Site Reports

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-----------------------|-------------|--------------------------|----------------|
| COMPUTER APPLICATIONS | CEN 522 | 10/Longitudinal | 2,0,3 |

Computers in Engineering. Computer programming methods. Matrix algebra language and co aided design of slabs beams and columns

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|---------------|-------------|--------------------------|----------------|
| BRIDGE DESIGN | CEN 523 | 10/Longitudinal | 3,1,0 |

Superstructure and substructure design. Design of simple span and continuous span bridges, including slab, beam and truss types. Introduction to orthotropic steel plate deck bridges. Suspension bridges.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|---------------------------------|-------------|--------------------------|----------------|
| ELECTIVE II: FROM CE DEPARTMENT | CEN 55- | 10/Longitudinal | 3,1,0 |

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-----------------------|-------------|--------------------------|----------------|
| GRADUATION PROJECT II | CEN 590 | 10/Longitudinal | 0,3,0 |

This is the implementation phase of the capstone project that is a continual project over two semesters, and involves number of students working as one team tackling different aspects of the civil engineering works, which may involve research and development work, engineering design, literature survey, experimental work, theoretical work, computational studies, simulation, and implementation. Students will be assigned an research and development project, and all work conducted during the semester must be compiled in a final report and orally presented to the examining committee at the end of the Semester.

List of Elective Courses

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|--|-------------|--------------------------|----------------|
| Introduction to Finite Element Methods | CEN 551 | 10/Longitudinal | 3,1,0 |

Principles of Finite Element Method of analysis. Definitions and mathematical analysis. Application of principles of Finite Element Methods to the design and analysis of civil engineering structures.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|------------------|-------------|--------------------------|----------------|
| Plastic Analysis | CEN 552 | 10/Longitudinal | 3,1,0 |

Yield line theory of slabs, yield line, virtual work criterion, application to slabs of different geometry and support condition. Plastic analysis of beams and frames, upper and lower bound theory. Mechanism and static method of analysis. Instantaneous centric plastic moment distribution. Application to beams frames.

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|------------------------|-------------|--------------------------|----------------|
| Irrigation Engineering | CEN 553 | 10/Longitudinal | 3,1,0 |

Soil-water relationship as related to application to irrigation water, Irrigation scheduling for crops, Operation of irrigation projects, Design of canals and drains, Irrigation methods, Layout of canalization and drainage systems for agricultural schemes

| <i>Title</i> | <i>Code</i> | <i>Semester/Duration</i> | <i>Credits</i> |
|-----------------|-------------|--------------------------|----------------|
| Pavement Design | CEN 554 | 10/Longitudinal | 3,1,0 |

Road pavement: flexible & rigid pavement, Pavement structural design, Pavement materials & testing: granular materials, bituminous materials & Asphalt Concrete Mixture, Pavement Construction: construction equipment & construction stages, Highway drainage, Highway maintenance.