



KENYATTA UNIVERSITY

School of Engineering & Technology

Department of Civil Engineering

**Revised Curriculum for Accreditation
by
Engineers' Board of Kenya (EBK)**

**BACHELOR OF SCIENCE
(CIVIL ENGINEERING)**

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1.0 INTRODUCTION

1.1 University Background Information

Kenyatta University (KU) was founded in 1985 on our main campus which is set on 1000 acres within a serene environment along Thika Road about 30km from the city centre of Nairobi. Kenyatta University is the second oldest public university in Kenya.

The institution is deeply committed to upholding the responsibility that comes with its rich history. Being public, KU has always been accessible. Our students who hail from diverse backgrounds both locally and internationally continue to enjoy and be enriched by all that KU offers including a world-class library, well-equipped laboratories, art, sports and the impressive Chandaria Business Innovation and Incubation Centre, where young entrepreneurs with innovative projects are nurtured to scale up their ideas into viable spin-off companies.

Kenyatta University is home to some of the world's best scholars, researchers and experts in their fields. We pride ourselves in providing high quality programmes that attract individuals who wish to acquire skills that the global market needs.

Kenyatta University identifies itself as a community of scholars committed to the generation and dissemination of knowledge and cultivation of wisdom for the welfare of society.

Its core values are; Excellence, Academic Freedom, Professionalism, Creativity, Innovation, Truth, Self Reliance, Equal Opportunity, Relevance and Moral Integrity.

Kenyatta University was the first public university to attain the enviable ISO 9001:2000 certificate on Quality Management Systems. The certificate has been upgraded to ISO 9001:2008 after being audited several times. This ensures and calls for continuous improvement in processes and service delivery to our esteemed customers and employees.

The objectives of Kenyatta University are to:

- Promote the development and expansion of higher education opportunities through initiation of new programmes and alternative modes of delivery using, among others, modern technologies.
- Enhance the level of participation in research, dissemination and preservation of knowledge for both academic and societal development.
- Promote human resource development and proactive management practices, as well as good governance, to enhance service delivery.

- Provide an environment that nurtures excellence and high standards of professionalism in teaching, learning, research and community service.
- Create equal opportunities for those qualified to pursue university education.
- Institutionalize quality assurance practices in planning, implementation and evaluation of the University's core functions in order to meet the set goals.
- Promote the development of the students welfare systems for the attainment of academic excellence and an all-round education.
- Provide facilities in collaboration with other approved institutions for enhancing access to higher education

1.2 Vision

The vision of Kenyatta University is to be a dynamic, inclusive and competitive Centre of excellence in teaching, learning, research and service to community.

1.3 Mission

The Mission of Kenyatta University is to provide quality education and training, promote scholarship, service, innovation and creativity and inculcate moral values for sustainable individual and societal development.

1.4 Philosophy

Kenyatta University's philosophy is sensitivity and responsiveness to societal needs and the right of every person to knowledge.

1.5 Minimum Admission Requirements

- i. Admission requirements are set by Senate from time to time in liaison with the Kenya Universities and Colleges Central Placement Service.
- ii. Entry Requirements for Various Programmes:
 - General University guidelines shall apply. In addition, applicants must meet specific degree requirements for each school.
 - Admission requirements guidelines may be supplemented by circulars from Senate as issued from time to time.
 - A minimum of Grade C+ at the Kenya Certificate of Secondary Examination (KCSE) or equivalent. This entry requirement should be regarded as the minimum, which in no way entitles an applicant to a place at the university.

1.6 Academic Organization of the Programmes

Kenyatta University offers two types of undergraduate programmes.

- i. Bachelors Degree programmes through the Kenya Universities and Colleges Central Placement Services (KUCCPS). Students in this category go through a regular study period that comprises two semesters per academic year.
- ii. Kenyatta University Self-Sponsored Programmes at certificate, diploma and undergraduate levels. This includes Institutional Based Programmes, Virtual Learning, Continuing Studies, Self Sponsored and Open, Distant and e-Learning. Students in this category have sessions and trimester periods.

The University also offers masters and doctoral programmes in various disciplines that may take any of the above learning modes.

2.0 CIVIL ENGINEERING PROGRAMME

2.1 Philosophy

The Civil Engineering programme's philosophy is sensitivity and responsiveness to societal infrastructural needs.

2.2 Programme Goal

To provide quality civil engineering education that meets the needs of a dynamic society.

2.3 Rationale

Vision 2030 has a component of infrastructural development. To address the challenges associated with such development, there will be need for professional Civil Engineers. This programme is designed to meet the national as well as global challenges in civil engineering in line with vision 2030 and beyond. The programme is designed to produce graduates who will be effective practitioners of the engineering profession as civil engineers as per requirements of Engineers Board of Kenya (EBK). It takes cognizance of the local conditions for the practice of engineering, the demands and state of development of the civil engineering sector in Kenya, technology trends and training organization globally.

The civil engineering programme is designed to develop engineers who have a strong background in mathematics and science, who are articulate, and who understand the nature of their special role in society and the impact of their work on the progress of civilization. The curriculum is designed to guarantee a certain breadth of knowledge of the civil engineering disciplines through a set of core courses and focus in: **Water Resources and Public Health Engineering, Structural Engineering, Geotechnical Engineering, Transportation and Highway Engineering** through primary and secondary areas of specialization.

Such concepts as design and construction of dams and new concepts of design and construction of superhighways such as Thika highway have been incorporated in the programme. Design studios have also been introduced to help students design structures from inception to completion.

The programme will provide a graduate with the requisite foundations for specialized postgraduate programmes in civil engineering. In developing the programme considerations were also made of the requirements of accreditation of the Engineers Board of Kenya (EBK).

2.4 Structure and Mode of Delivery

The programme is designed so that a student completes the degree in a period of five academic years. Throughout the course of study, the student is expected to take a minimum of 16 units in any given year of study. To facilitate hands on practical experiences, Civil Engineering students shall have a third semester in second, third and fourth years in conformity with the requirements of the Engineering Board of Kenya (EBK). During the second year third semester, the students will undertake a compulsory practical attachment while during the third and fourth years, they will undertake compulsory industrial attachments.

A semester shall consist of sixteen (16) weeks two of which are for examination. The teaching hours for each practical unit shall be two hours lecture, one hour tutorial and

three hours of laboratory work whereas the teaching hours for theoretical units shall be two hours lecture and two hours tutorial.

The mode of delivery shall be face-to-face and on a full-time basis.

2.5 Academic regulations

2.5.1 Entry Requirements

- i The candidate must have passed K.C.S.E. with a minimum of C+ or equivalent examination at the grades indicated below:

Mathematics	B+
Physics	B+
Chemistry	B
English	B
Geography/Biology	B

- ii National Diploma holders in Civil Engineering, Building Construction or Water Engineering from Kenya Polytechnic, Mombasa Polytechnic, Kenya Water Institute and other recognized institutions will be accepted as follows:

1) Higher Diploma or Equivalent

A candidate with at least a credit pass in the Higher Diploma shall be eligible for admission into the programme. A qualified Higher Diploma applicant shall normally be admitted into the second year of study or given equivalent credit transfer.

2) Basic University Diploma or Ordinary Diploma or Equivalent

A candidate with at least a credit pass in the Ordinary Diploma or University Basic Diploma (lasting at least 3 academic years) and who in addition had attained at least a C (Plain) for mean aggregate and C+ (Plus) in Mathematics and Physics at the KCSE shall be eligible for admission into the

programme. A qualified diploma applicant shall normally be admitted in to the second year of study or given equivalent credit transfers.

2.5.2 Examination Regulations

- i. Design units to be assessed by continuous assessment tests 40% and design projects 60%.
- ii. For non design units the final examination will constitute 70% of the total marks while lab work, continuous assessment tests and assignments will constitute 30%.
- iii. The pass mark for each course shall be 40%.
- iv. Assessment of practical attachment shall be based on student's log-book, report and supervisor's evaluation report. It shall be graded as pass or fail.

Supplementary Examinations

- i. Any examination in a unit taken by a candidate as a result of failing the unit at the first attempt is a supplementary examination.
- ii. Supplementary examination period shall normally be at the end of a year of study in which the unit is offered.
- iii. A candidate who fails in any unit, up to a maximum of four units per semester at the ordinary examination shall be required to sit supplementary examinations in all the failed units during the supplementary period immediately following the ordinary examinations in which he/she failed the units. A candidate who fails more than half the units taken in any semester shall be required to repeat the academic year and served with an academic warning by the Dean of the School of Engineering and Technology upon recommendation by the University Board of Examination.
- iv. A candidate who fails a unit at the supplementary examination period shall be required to re-sit the examination during the next time the unit is offered at the ordinary examinations.
- v. A candidate who fails a supplementary examination of any year of study

during the supplementary examination period shall not be allowed to proceed to the next year of study but shall be required to re-sit the examination during the next time the unit is offered at the ordinary examinations

Special Examinations

If through unavoidable circumstances such as bereavement or sickness a candidate is unable to sit for one or more examination papers, or is unable to undertake essential parts of the work for continuous assessment the candidate may, on the recommendation of the School Board of Examiners, and with the approval of Senate, be permitted to take special examination or undertake extra work for continuous assessment. Special examinations shall not be allowed for students sitting for supplementary Examinations.

Discontinuation

- i A candidate who does not pass a unit after a total of three attempts shall be discontinued. In this case the three attempts shall normally be as follows:
 - 1) First attempt shall be at ordinary examinations.
 - 2) Second attempt shall be at supplementary examinations period following failure at the ordinary examinations
 - 3) Third attempt will be following failure at second supplementary examinations which will be taken at the ordinary examination period.
- ii A candidate who fails more than half of the units of a year of study after the first attempt and subsequently fails the same units after re-sitting the examinations shall be discontinued.
- iii A candidate who fails to complete the first and second years of study in three academic years shall be discontinued.
- iv A candidate who fails to complete the third, fourth and fifth years of study in five academic years shall be discontinued.

2.5.3 Graduation Requirements

To qualify for the award of the degree, the candidate should have successfully taken a minimum of 80 units of which 77 are compulsory and three (3) are electives.

A student who intends to graduate should apply to the Registrar (Academic).

2.5.4 Degree Classification

- a) The final classification of the degree will be based on all the required Units (core and electives) taken during the degree programme. The total number of units required for degree classification is already stated above.
- b) Students are not allowed to graduate with any failed required (core or elective) unit.
- c) The total score will be based on cumulative score average to arrive at the following final classification:
 1. 70 -100% First Class Honours
 2. 60 - 69% Second Class Honours (Upper Division)
 3. 50 - 59% Second Class (Lower Division)
 4. 40 - 49% Pass
 5. 0 – 39% Fail

2.6 Course Evaluation

The programme will from time to time be evaluated to ensure it meets and possibly surpasses its goal and objectives. This will be accomplished through convening stakeholder workshops and linkages with industry from which essential feedback is obtained. Evaluation by learners and other useful mechanisms shall be employed.

2.7 Management and Administration

The program will be administered by the Civil Engineering Department in the School of Engineering and Technology of Kenyatta University. The department has appointed three adjunct professors as thematic leaders and who will offer general academic leadership for the programme. Internal quality assurance mechanisms guided by ISO 9001: 2008 will be used to assure of continued quality.

2.8 Academic resources for the Civil Engineering Programme

Substantial resources are available for the programme. The university enjoys a post-modern library which is well equipped for the programme in terms of books, journals and e-learning materials. A water quality laboratory and workshop are also available. The university is currently constructing another workshop and lab space to house hydraulics, soil mechanics and concrete laboratories. Equipment for these workshop/labs has been procured and is in various stages of delivery. Another phase of equipment procurement is underway in the new financial year. Quotations for equipment in this phase are in the analysis stage.

The university has lecture halls which are fully equipped for at least 50 students in each level of learning.

2.9 LIST AND COURSE DISTRIBUTION TABLE

2.9.1 First Year of Study

First Semester

Code	Course Title	Units	Contact Hours
UCU 100	Communication Skills	1	35
UCU 101	Development Studies	1	35
ECU 100	Chemistry for Engineers I	1	56
ECU 101	Physics for Engineers I	1	56
ECU 104	Engineering Mathematics I	1	48
ECU 105	Engineering Mathematics II	1	48
ECU 109	Fundamentals of Computing	1	56
ECV 101	Material Science	1	56
	Total	8	390

Second Semester

Code	Course Title	Units	Contact Hours
UCU 103	Introduction to Creative and Critical Thinking	1	35
ECU 102	Chemistry for Engineers II	1	56
ECU 103	Physics for Engineers II	1	56
ECU 106	Engineering Mathematics III	1	48
ECU 107	Engineering Mathematics IV	1	48
ECU 108	Introduction to Engineering Profession	1	48
ECV 100	Engineering Drawing I	1	56
ECV 102	Computer Programming I	1	56
	TOTAL	8	403

2.9.2 Second Year of Study

First Semester

Code	Course Title	Units	Contact Hours
ECU 200	Engineering Mathematics V	1	48
ECU 201	Engineering Mathematics VI	1	48
ECV 200	Engineering Drawing II	1	56
ECV 201	Surveying I	1	56
ECV 202	Fluid Mechanics I	1	56
ECV 203	Strength of Materials I	1	56
ECV 204	Theory of Structures I	1	56
ECV 205	Civil Engineering Materials I	1	56
	Total	8	432

Second Semester

Code	Course Title	Units	Contact Hours
ECU 202	Engineering Mathematics VII	1	48
ECU 203	Engineering Mathematics VIII	1	48
ECV 206	Surveying II	1	56
ECV 207	Fluid Mechanics II	1	56
ECV 208	Strength of Materials II	1	56
ECV 209	Theory of Structures II	1	56
ECV 210	Civil Engineering Materials II	1	56
ECV 211	Electromechanical Engineering	1	56
	Total	8	432

ECV 212 Practical Attachment – Internal (12 Weeks)

2.9.3 Third year of Study

First Semester

Code	Course Title	Units	Contact Hours
ECU 300	Engineering Mathematics IX	1	48
ECV 300	Engineering Geology	1	56
ECV 301	Soil Mechanics I	1	56
ECV 302	Hydraulics I	1	56
ECV 303	Public Health Engineering I	1	56
ECV 304	Surveying III	1	56
ECV 305	Theory of Structures III	1	56
ECV 306	Transportation Planning and Development	1	56
	Total	8	440

Second Semester

Code	Course Title	Units	Contact Hours
ECU 301	Engineering Mathematics X	1	48
ECU 302	Innovation and Entrepreneurship for Engineers	1	56
ECV 307	Hydrology I	1	56
ECV 308	Soil Mechanics II	1	56
ECV 309	Hydraulics II	1	56
ECV 310	Public Health Engineering II	1	56
ECV 311	Surveying IV	1	56
ECV 312	Theory of Structures IV	1	56
	Total	8	440

ECU 303 Industrial Practical Attachment I (12weeks)

2.9.4 Fourth Year of Study

First Semester

Code	Course Title	Units	Contact Hours
ECU 400	Research Methodology	1	48
ECU 401	Project Management	1	48
ECV 400	Traffic Engineering I	1	56
ECV 401	Highway Engineering I	1	56
ECV 402	Irrigation Engineering I	1	56
ECV 403	Foundation Engineering I	1	56
ECV 404	Structural Design I (Studio)	1	56
ECV 405	Theory of Structures V	1	56
	Total	8	432

Second Semester

Code	Course Title	Units	Contact Hours
ECU 402	Engineering Economics	1	48
ECV 406	Transportation Engineering	1	56
ECV 407	Hydrology II	1	56
ECV 408	Traffic Engineering II	1	56
ECV 409	Highway Engineering II	1	56
ECV 410	Irrigation Engineering II	1	56
ECV 411	Foundation Engineering II	1	56
ECV 412	Structural Design II (Studio)	1	56
	Total	8	440

ECU 403 Industrial Practical Attachment II (12 Weeks)

2.9.5 Fifth Year of Study

First Semester

Code	Course Title	Units	Contact Hours
ECU 500	Engineering Practice and Ethics	1	48
ECV 500	Civil Engineering Project I	1	56
ECV 501	Structural Design III (Studio)	1	56
ECV 502	Water Resources Engineering I	1	56
ECV 503	Highway Materials	1	56
ECV 504	Construction Management	1	48
ECV 505	Environmental Engineering	1	56
ECV 506	Public Health Engineering III	1	56
	Total	8	432

Second Semester

Code	Course Title	Units	Contact Hours
ECV 523	Civil Engineering Project II	1	56
ECV 507	Geotechnical Engineering	1	56
ECV 522	Design and Construction Of Dams	1	56
ECV 509	Civil Engineering Practice	1	56
ECV 510	Logistics and System Analysis in Transportation	1	56
	Electives (A student to select Only Three units from the following groups)		
	Water Resources and Public Health Engineering (Option 1)		
ECV 511	Public Health Engineering IV	1	56
ECV 512	Water Resources Engineering II	1	56
ECV 513	Groundwater Abstraction and Recharge	1	56

	Structural Engineering (Option 2)		
ECV 514	Theory of Structures VI	1	56
ECV 515	Structural Design IV (Studio)	1	56
ECV 516	Mechanics of Composite Materials	1	56
ECV 517	Design of Bridges	1	56
	Transport And Highway Engineering (Option 3)		
ECV 508	Coastal Engineering	1	56
ECV 518	Pavement Design	1	56
ECV 519	Transportation, Urban and Regional Planning	1	56
ECV 520	Urban Traffic Management	1	56
ECV 521	Advanced Engineering Surveying	1	56
	Total	8	448

3.0 COURSE DESCRIPTION

3.1 First Year of Study

3.1.1 First Semester

UCU 100: Communication Skills

Prerequisites: KCSE

Objective

The objective of the course is to equip students with skills to acquire knowledge and effectively communicate their views to others, orally and in writing.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Demonstrate ability to write essays.
2. Demonstrate ability to communicate views.
3. Demonstrate ability to plan, organize, store and retrieve information.
4. Display competence in oral, written and visual communication.

Course Description

Reading skills: Listening skills: Library skills: Collecting and abstracting information:

Speaking skills: Writing skills: analyzing tasks, planning, drafting and editing various types of writing skills:

Study techniques: Planning work, organizing, storing and retrieving information.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30%: where 20% shall be continuous assessment tests and 10% shall be assignments.

Suggested Textbooks and References

1. 101 Ways to Improve Your Communication Skills Instantly, 4th Edition by Bennie Bough, Publisher: Goal Minds, Inc.; 4 edition (September 15, 2005) ISBN-10: 097409708X
2. The Elements of Technical Writing (Elements of Series) (Paperback) by Gary Blake, Robert W. Bly, Publisher: Longman; 1st edition (December 19, 2000) ISBN-10: 0020130856
3. The Handbook of Technical Writing, Eighth Edition by Gerald J. Alred, Charles T. Brusaw, and Walter E. Oliu, Publisher: St. Martin's Press; 8th edition (March 7, 2006) ISBN-10: 0312352670

UCU 101: Development Studies

Prerequisites: KCSE

Objective

The objective of the course is to equip students with conceptual tools for analysis of national development.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Explain the concepts of development and apply them in context of African country.
2. Discuss the gender issues in the context of development.
3. Discuss factors which affect development.

Course Description

Concepts of development, underdevelopment: Theories of development and underdevelopment: Historical roots of African development and underdevelopment: Concept of Gender and rationale for mainstreaming gender: Approaches to development: Development strategies, indicators, problems and regional integration, population, resources and development, agriculture and rural development, urbanization, industrialization and development, science, technology and development, law, justice, politics and development, ethics, morality and development.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

- 1) Introduction to Development Studies by Hennie Swanepoel(Editor), Frik de Beer (Editor) Oxford University Press Southern Africa; 2nd edition (May 31, 2001) ISBN-10: 0195718593
- 2) An Introduction to Sustainable Development by Jennifer A. Elliott, Publisher: Taylor and Francis; 3 edition (March 14, 2007)

ECU 100: Chemistry for Engineers I

Prerequisites: KCSE Chemistry

Objective

The objective of the course is to provide a student with an insight into fundamental aspects of atomic structure, the periodic table and the link to the chemistry of the elements

including organic chemistry.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. State the fundamental properties of matter, number of protons, neutrons and electrons.
2. Describe the periodic arrangement of elements in the periodic table.
3. Describe the Chemistry of elements along some periods and down some groups of periodic table.
4. Describe types of bonding, covalent, ionic, metallic etc.
5. Understand characteristics and significance of some salts and elements.

Course Description

Structure of atoms: Model of atoms; the fundamental particles of the atom, Planck's quantification of energy and the photoelectric effect, ionization energy; nature of ionic and covalent compounds: Molecular shape chemical bonds, size and bond force: liquid and solid matters; structure of liquids; structure of solids; measurements and mole concept; properties of gases; law of gases: Chemical Reactions: Stoichiometry, thermochemical energy, heat and enthalpy, Periodic table: Main group elements I, main group elements II, d-Block transition elements: Organic chemistry: Simple organic functional group chemistry; alkanes, alkenes, alkynes, alky halides, alcohols, ketones, aldehydes, carboxylic acids and esters; chemistry of benzene, nuclear chemistry: Radioactivity, nuclear Energy.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and Laboratory work: 3 hours per week

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests, 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four of the experiments listed below.

1. Testing for the presence of carbon double bonds.
2. Test for Aldehydes: Tollens Reaction - Silver Mirror Test or Schiff's Reagent test.
3. Test for aromatic Rings
4. Test for carboxylic acids and/or esters
5. Tests for other functional groups: Alkanes, alkenes, alkynes, alky halides, alcohols, ketones.

Textbooks and References

1. Suggested Textbooks:

- Chemistry For Engineers: An Applied Approach by Mary Jane Shultz, Houghton Mifflin Company, 2006
- Chemistry in Context by Graham Hill and John Holman, Nelson Thornes publishers,

2000.

2. Suggested References

- a) Inorganic Chemistry by Gary Miessler and Donald A Tarr, Prentice Hall 2008
- b) Physical Chemistry by Thomas Engel and Philip Reid, Benjamin Cummings Publishers, 2005.
- c) Chemistry by Steven S. Zumdahl and Susan A. Zumdahl, Houghton Mifflin Company, 2007
- d) Introduction to Engineering Chemistry by S. Dara, Chand (S.) and Co Ltd, India, 2005
- e) Schaum's Outline of College Chemistry, 9th edition, by Jerome Rosenberg, Lawrence M. Epstein and Peter Krieger, McGraw-Hill, 2007

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECU 101: Physics for Engineers I

Prerequisites: KCSE Physics

Objective

The objective of the course is to impart knowledge of basic principles on motion, forces on rigid bodies, heat and their interaction with matter.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. List the mechanical properties of matter.
2. State and apply the Newton's Laws of motion.
3. Describe Kinematic and dynamic – circular motion and simple harmonic motion.
4. Describe flow of liquids.
5. State the laws of thermodynamics.
6. List thermal properties of matter.

Course Description

Mechanics and properties of matter: mass centre, work, force, energy, impulse, momentum, vectors, rectilinear motion, Newton's Laws of motion and their applications: Composition and resolution of forces: Uniform circular motion: Newton's law of gravitation: Simple harmonic motion: Determination of gravity. Flow of liquids: Viscosity: Surface tension: Elasticity: elastic constants and their importance: Thermal physics: expansion of matter: Temperature scales: First law of thermodynamics; specific heat capacities of gases. Kinetic theory of gases: Mechanism of heat transfer, thermal conductivity, black body, Stephen's law: Sound: equation of wave motion and velocity of sound in matter.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and Laboratory work: 3 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests, 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four of the experiments listed below.

1. Determination of light wavelength from interference patterns in Young's two-slit experiments
2. Experimental demonstration of Newton's first and second laws of motion.
3. Determination of the surface tension of soap solutions.
4. Determination of light wavelength from diffraction patterns in Young's single slit experiments.

Textbooks and References

1. Suggested Textbook:

- University Physics, by Hugh D. Young and Roger A. Freedman, Addison Wesley, 2007.
- Physics for Engineers by Hans C. Ohanian and John Markert, W W Norton and Co Ltd, 2007.

2. Suggested References

- College Physics by Alan Giambattista, Betty Richardson and Robert C. Richardson, McGraw-Hill, 2006.
- Physics for Scientists and Engineers: A Strategic Approach by Randall D. Knight, Addison Wesley, 2003.
- Physics by John D. Cutnell and Kenneth W. Johnson, Wiley Inc., 2006.
- Physics for Scientists and Engineers by Douglas C. Giancoli, 3rd Edition, Prentice Hall, 2000.
- Physics for Scientists and Engineers by Paul A. Tipler and Gene Mosca, W. H. Freeman 2007.
- Physics for Scientists and Engineers by Raymond A. Serway and John W. Jewett, Brooks Cole, 2003.
- College Physics by Raymond A. Serway, Jerry S. Faughn, Chris Vuille, and Charles A. Bennett, Brooks Cole, 2005.
- Schaum's Outline of College Physics, by Frederick J. Bueche and Eugene Hecht, 10th edition, McGraw-Hill, 2005.
- Vibrations and Waves by A. P. French, W. W. Norton, 1971.

3. Journals and on-line materials (provided by KU Library)

- c) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications

d) Ebrary, Springerlink, Data World Bank

ECU 104: Engineering Mathematics I

Prerequisites: KCSE Mathematics

Objective

The objective of the course is to impart knowledge on geometry, vectors and their applications.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Apply the equation of a straight line to tangents and normals including parametric forms.
2. Carry out algebraic manipulation of vectors in two and three dimensions.
3. Apply knowledge of vectors to plane trigonometry, forces and velocity problems.

Course Description

The straight line: Equation of parallel and perpendicular lines; directed and undirected distances: The circle: General equation and equation at a tangent at a point of contact and from an external point: Polar coordinates and their definitions, relationship with Cartesian coordinates, graphs and equations: Ellipse parabola and hyperbola: Equations in standard form and with change of origin: Chord, tangent and normal including parametric form: Vectors: In two and three dimensions; addition, subtraction, multiplication by scalars, resolution, scalar and vector products; velocity and acceleration vectors. Applications to plane trigonometry, geometry of straight line in two and three dimensions, curve in two dimensions, and resultant force and velocity.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 20% shall be continuous assessment tests and 10% shall be assignments.

Suggested Textbooks and References

1. Textbooks: Any one of the following

- Jordan D. W., and Smith P., Mathematical Techniques, An introduction for the engineering, physical and mathematical sciences; Second edition, Oxford University Press, 1997.
- Kaplan W., Advanced Calculus, Second Edition, Addison-Wesley Publishing Company, 1973.

2. References:

- 1) Pearson Carl E. (Ed); Handbook of applied Mathematics, Second Edition, Van Nostrand Reinhold, New York, 1990.

- 2) Handbook of Mathematics for Engineers and Scientists, Andrei D. Polyainin and Alexander V. Manzhirov; Chapman and Hall/CRC; 1edition (2006), ISBN 1584885025.
 - 3) Schaum's Outline of Advanced Mathematics for Engineers and Scientist, Murray R Spiegel, Publisher: McGraw-Hill; 1 edition, ISBN: 0070602166.
 - 4) Advanced Engineering Mathematics with MATLAB (Bookware Companion), Thomas L. Harman, James B. Dabney, and Norman John Richert; Publisher: Cengage Engineering; 2nd edition (1999) Language: English ISBN-10: 0534371647.
4. Journals and on-line materials (provided by KU Library)
- e) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
 - f) Ebrary, Springerlink, Data World Bank

ECU 105: Engineering Mathematics II

Prerequisites: KCSE Mathematics

Objective

The objective of the course is to impart knowledge on the algebra with respect to permutations and combinations, series and common functions, and complex numbers.

Expected learning Outcome:

Upon completion of this course the student will be able to:

1. perform permutations and combinations and to apply them in solution of problems.
2. Demonstrate the different types of functions, their simplifications and applications, and the application of the remainder theorem.
3. Manipulate equations involving complex numbers and hyperbolic functions.

Course Description

Algebra: Surds, logarithms and indices: Quadratic functions, equations and inequalities; exponential functions; trigonometric functions, graphs and inverse for degree and radian measure, addition multiple angle and factor formulae; trigonometric identities and equations; Sine and Cosine rule; standard trigonometric formulae: Hyperbolic functions; Sinh and Cosh, Hyperbolic Identities (Osborne's rule): Permutations and combinations: Binomial theorem and its application: Remainder theorem and its applications to solution of factorisable polynomial equations and inequalities: Complex numbers: arithmetic operations and geometric representations; modulus; arguments; De Moivre's theorem; applications: Roots of complex numbers; Hyperbolic functions; properties; graphs; identities.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 20%

shall be continuous assessment tests and 10% shall be assignments.

Suggested Textbooks and References

1. Textbooks: Any one of the following

- Jordan D. W., and Smith P., *Mathematical Techniques, An introduction for the engineering, physical and mathematical sciences; Second edition*, Oxford University Press, 1997.
- Kaplan W., *Advanced Calculus, Second Edition*, Addison-Wesley Publishing Company, 1973.

2. References:

- 1) Pearson Carl E. (Ed); *Handbook of applied Mathematics, Second Edition*, Van Nostrand Reinhold, New York, 1990.
- 2) *Handbook of Mathematics for Engineers and Scientists*, Andrei D. Polyaniin and Alexander V. Manzhirov; Chapman and Hall/CRC; 1edition (2006), ISBN 1584885025.
- 3) *Schaum's Outline of Advanced Mathematics for Engineers and Scientist*, Murray R Spiegel, Publisher: McGraw-Hill; 1 edition, ISBN: 0070602166.
- 4) *Advanced Engineering Mathematics with MATLAB (Bookware Companion)*, Thomas L. Harman, James B. Dabney, and Norman John Richert; Publisher: Cengage Engineering; 2nd edition (1999) Language:English ISBN-10: 0534371647.

3. Journals and on-line materials (provided by KU Library)

- g) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- h) Ebrary, Springerlink, Data World Bank

ECU 109: Fundamentals of Computing

Prerequisites: KCSE Mathematics

Objective

The objective of the course is to give basic competencies for application of a computer to everyday tasks using standard packages.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Describe the organization and operation of a computer processor, and primary and secondary memory, peripheral devices and to give computer specifications.
2. Explain the representation of data and information in computer systems.
3. Use standard word, and spreadsheets, graphics generation packages.
4. Use standard database systems.
5. Use the network based software tools.

Course Description

Introduction: History of computers: Computer and society: computer hardware and software: Understanding PC specifications, Computer performance and maintenance. Hardware components: CPU, Memory and I/O buses. Computer applications: exercise using word processing software and presentation graphics software; spreadsheets; Database (exercises in Access): Web Application (exercise in HTML): Machine level representation of data: Bits, bytes, and words; numeric data representation and number bases; representation of character data. Overview of operating systems: simple management: Introduction to net-centric computing: background and networking fundamentals. The Internet: use of networking software including e-mail, telnet, and FTP. Models of computation. Computers and information processing. General introduction to programming. Introduction to Algorithms and flow charts.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% where 15% shall be continuous assessment tests and 15% shall be assignments.

Computer Laboratory Exercises

Each student is expected to carry out at least seven computer laboratory exercises prescribed by the course lecturer.

Suggested Textbooks and References

1. Textbooks: Any one of the following

(a) Introduction to Languages and Theory of Computation, John MARTIN, McGraw-Hill, 2006

2. References:

(a) Learn to Program with Visual Basic.Net, John SMILEY 2007, A-Press, ISBN 056678-6,

(b) Programming with Objects: A Comparative Presentation of Object Oriented Programming with C++ and Java by Avinash Kak, Wiley-IEEE Press, 2003.

(c) The Fortran 2003 Handbook: The Complete Syntax, Features and Procedures; Jeanne C. Adams (Author), Walter S. Brainerd (Author), Richard A. Hendrickson, Richard E. Maine, Jeanne T. Martin, Brian T. Smith, Publisher: Springer; 1 edition (2008) ISBN 1846283787.

3. Journals and on-line materials (provided by KU Library)

i) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications

j) Ebrary, Springerlink, Data World Bank

ECV 101: Material Science

Prerequisites: ECU 100: Chemistry for Engineers I and ECU 101: Physics for Engineers I

Objective

The objective of the course is to impart basic knowledge on structure and nature of materials.

Expected Learning Outcomes

At the end of the course students should be able to:

1. State the structure of material elements and periodic table.
2. Describe chemical and physical properties of materials.
3. Carry out basic material test.
4. Select materials e.g. cement, glass, concrete etc.

Course Content

Structure and Nature of Materials: Atoms and elements as building blocks. Periodic table of the elements. Nature of engineering materials; metals, ceramics, polymers, composites. Properties of Engineering Materials: Physical properties, mechanical properties, Chemical properties, electrical properties. Mechanical Testing of Materials: Tensile test, compression test, hardness tests, impact tests, fatigue tests, creep test, fracture toughness tests, flexural test. Overview of Materials Selection: Ferrous and non-ferrous metals and alloys, plastics, traditional ceramics, technical ceramics, glass, engineering gels (Portland cement, tar,

bitumen), concrete, steel reinforced concrete, wood, organic and inorganic fibres, fibre-reinforced plastics.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 15% shall be continuous assessment tests and 15% shall be assignments.

Textbooks and References

1. Textbook:

(a) Michael S. Mamlouk and John P. Zaniewski; Materials for Civil and construction Engineers. 2nd ed. 2005, Prentice Hall, ISBN:0131477145.

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

3.1.2 Second Semester

UCU 103: Introduction to Creative and Critical Thinking

Prerequisites: KCSE

Objective

The objective of the course is to inculcate in a student critical attitude and to impart an understanding of creative thinking.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Effectively discuss morality, the individual and the society.
2. Discuss goals of education.
3. Participate in intellectual discourse.

Course Description

Topics such as self-examination; individually; collectively; morality; Meaning of education; critically and creativity; intellectual standards (accuracy, clarity, precision, relevance); intellectual dispositions; elements of reasoning; assumptions; evidence; inferences; deduction; induction; validity; soundness; fallaciousness and their consequences.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. The Art of Thinking: A Guide to Critical and Creative Thought (8th Edition) by Vincent R. Ruggiero, Up and Out: Using Critical and Creative Thinking Skills to Enhance
2. Learning by Andrew P. Johnson (Jul 18, 1999), Allyn and Bacon, ISBN: 0205297315.

ECU 102: Chemistry for Engineers II

Prerequisites: ECU 100: Chemistry for Engineers I

Objective

The objective of the course is to provide the students with the basics of physical chemistry.

Expected Learning Outcomes

At the end of the course, students should be able to:

1. Carry out titration measurements and apply such measurements to determine types of reactants.
2. Determine the chemical reaction mechanisms and equilibrium curves.
3. Calculate the e.m.f of a sample cell and a concentration.

Course Description

Properties of gases: Physical equilibria: Raolt's Law; Solid-liquid equilibrium (SLE); Colligate properties; Liquid-liquid equilibrium (LLE); Chemical equilibria: Reversible chemical reaction, equilibrium, Le-Chatelier's principle: Ionic equilibria, pH and buffer solutions; theory of acid/base indicators: Solubility and solubility products. Kinetics-Reaction Rates: Concentration and Rate, Reaction Mechanisms; Electrochemistry: half reactions, Galvanic Cells, and electrode potential, electromotive force (emf) of a cell: Practical on measurements of heat of dilution, reaction, neutralisation, potentiometer titration, pH, vapour pressure determinations and solubility product.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 10% shall be continuous assessment for tests, 5% shall be for assignments, and 15% for laboratory exercises. Each laboratory session shall be marked out of 10 marks and then aggregated

under the laboratory unit for the semester in which this course is offered.

Practical work/Laboratory Exercises

Each student is required to conduct at least four of the experiments listed below.

1. Titration experiments to determine the molarity of a base or acid.
2. Determination of the titration curves for weak acid/ strong base or strong base /strong acid or strong acid /weak base.
3. Experimental determination of the Avogadro's number
4. Relationship between Reactivity and Acid Strength: Reaction of Carboxylic Acids with Magnesium or any other such experiment.
5. Demonstration catalysis and of Le Chatelier's principle: Test for water in acid catalyzed esterification.
6. Effect of Concentration on the Rate of a Reaction

Textbooks and References

1. Suggested Textbooks:

- a) Chemistry For Engineers: An Applied Approach by Mary Jane Shultz, Houghton Mifflin Company, 2006
- b) Chemistry in Context by Graham Hill and John Holman, Nelson Thornes publishers, 2000.

2. References for all Chemistry units

- a) Inorganic Chemistry by Gary Miessler and Donald A Tarr, Prentice Hall 2008.
- b) Physical Chemistry by Thomas Engel and Philip Reid, Benjamin Cummings Publishers, 2005.
- c) Chemistry by Steven S. Zumdahl and Susan A. Zumdahl, Houghton Mifflin Company, 2007.
- d) Introduction to Engineering Chemistry by S. Dara, Chand (S.) and Co Ltd, India, 2005.
- e) Schaum's Outline of College Chemistry, 9th edition, by Jerome Rosenberg, Lawrence M. Epstein and Peter Krieger, McGraw-Hill, 2007.

3. Journals and on-line materials (provided by KU Library)

- k) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- l) Ebrary, Springerlink, Data World Bank

ECU 103: Physics for Engineers II

Prerequisites: ECU 101: Physics for Engineers I

Objective

The objective of the course is to impart knowledge of basic principles on electricity, magnetism, waves and optics.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. State and apply the basic laws governing electric and magnetic fields, viz., Ohms, Kirchhoff's laws, etc. describe the interaction between the electric and magnetic fields and a charged particles and a conductor respectively.
2. Student should describe DC laws and analysis.
3. Describe the basic concepts of quantum theory, X-ray generation, radioactivity, nuclear physics and their applications.

Course Description

Coulomb laws; electrical field and potential; capacitors; dielectrics; current and resistance; DC circuits; magnetic fields; electric measurement instruments; Ampere's and Biot-Savart law; induced electromotive force; electromagnetic induction; transient currents; AC circuits; Electromagnetic waves and photo reflection and diffraction; mirrors and prisms; scatter lenses and optic instruments; photometry; interference; diffraction and polarization; Particle and wave theories; phenomena of, and explanation of atomic spectra; X-rays.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests, 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four of the experiments listed below.

1. Determination of electrostatic force using parallel plate capacitors.
2. Study of air breakdown as an electrical insulator using a high voltage power supply and a simple spark gap.
3. Determination of light wavelength from interference patterns in Young's two-slit experiments.
4. Determination of the inductance of a solenoid.
5. Determination of the frequency of oscillation of a RLC circuit.

Textbooks and References

1. Textbooks

- University Physics, by Hugh D. Young and Roger A. Freedman, Addison Wesley, 2007.
- Physics for Engineers by Hans C. Ohanian and John Markert, W W Norton and Co Ltd, 2007.

2. References

- College Physics by Alan Giambattista, Betty Richardson and Robert C. Richardson, McGraw-Hill, 2006.
- Physics for Scientists and Engineers: A Strategic Approach by Randall D. Knight, Addison Wesley, 2003.
- Physics by John D. Cutnell and Kenneth W. Johnson, Wiley Inc., 2006.
- Physics for Scientists and Engineers by Douglas C. Giancoli, 3rd Edition, Prentice Hall, 2000.
- Physics for Scientists and Engineers by Paul A. Tipler and Gene Mosca, W. H. Freeman 2007.
- Physics for Scientists and Engineers by Raymond A. Serway and John W. Jewett, Brooks Cole, 2003.
- College Physics by Raymond A. Serway, Jerry S. Faughn, Chris Vuille, and Charles A. Bennett, Brooks Cole, 2005.
- Schaum's Outline of College Physics, by Frederick J. Bueche and Eugene Hecht, 10th edition, McGraw-Hill, 2005.
- Vibrations and Waves by A. P. French, W. W. Norton, 1971.

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECU 106: Engineering Mathematics III

Prerequisite: ECU 105: Engineering Mathematics II

Objective

The objective of the course is to impart knowledge on (a) generation and use of matrices in solution of large systems of equations, and (b) boolean algebra.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. State the algebraic properties of vectors and geometric applications
2. Express a systems of simultaneous equations in matrix form
3. State the properties of matrices, different types, and the algebraic manipulations rules,
4. Manipulate matrices using different techniques to use them to obtain solutions to systems of simultaneous, and hence to solution of selected physical problems. Linear equations
5. Generate boolean algebra truth tables and design basic switching circuits.

Course Description

Vectors: Coordinate systems, length of a vector, dot products, equations of lines and planes; cross products, algebraic properties, scalar triple products, vector moment, vector triple product. Linear Equations: Solution of linear equations, matrices and matrix algebra and operations, Cramer's rule; identity matrix, inverse and adjoint matrices and determinants, Gaussian elimination, singular matrices; sums and products of matrices. Eigenvalues and eigenvectors: Definitions; matrix diagonalizations; powers of matrices; use in matrix properties; application of eigenvalues and eigenvectors to physical systems. Boolean algebra: Laws, Truth Tables, OR, NOT, AND logic gates, inverse- truth tables, design of basic switching circuits.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. Textbooks: Any one of the following
 - a) Jordan D. W., and Smith P., Mathematical Techniques, An introduction for the engineering, physical and mathematical sciences; Second edition, Oxford University Press, 1997.
 - b) Kaplan W., Advanced Calculus, Second Edition, Addison-Wesley Publishing Company, 1973.

2. References:

- 1) Pearson Carl E. (Ed); Handbook of applied Mathematics, Second Edition, Van Nostrand Reinhold, New York, 1990.
- 2) Handbook of Mathematics for Engineers and Scientists, Andrei D. Polyinin and Alexander V. Manzhirov; Chapman and Hall/CRC; 1edition (2006),ISBN 1584885025.
- 3) Schaum's Outline of Advanced Mathematics for Engineers and Scientist, Murray R Spiegel, Publisher: McGraw-Hill; 1 edition, ISBN: 0070602166.
- 4) Advanced Engineering Mathematics with MATLAB (Bookware Companion), Thomas L. Harman, James B. Dabney, and Norman John Richert;Publisher: Cengage Engineering; 2nd edition (1999) Language:English ISBN-10: 0534371647.

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECU 107: Engineering Mathematics IV

Prerequisites: ECU 105: Engineering Mathematics II

Objective

The objective of the course is to introduce differential and integral calculus.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Derive derivatives of simple functions from basic principles.
2. Use differentiation rules.
3. Apply differentiation to numerically solve problems, to determine rates of change, and stationary points, and to relate these to physical problems.
4. Perform integration as reverse differentiation.
5. Apply integration to determine volumes and moments of inertia of bodies whose shapes can be described using simple functions.

Course Description

Derivatives: Notations and definition; limits; differentiation by first principles; functions continuity, differentiability of functions; sums, product, quotients, and chain rule; derivatives of algebraic, logarithmic, trigonometric, hyperbolic and exponential function of a single variable; higher order derivatives; parametric and implicit differentiation. Applications of derivatives: Small change, slopes, tangents and normals, rates of change; maxima, minima and points of inflection; sketching graphs of functions; Newton's Method for numerical solution of equations; Taylor series and approximations. Integration: Reverse differentiation; definite integrals and areas; indefinite and improper integrals;

differentiation and integration of complex functions; Applications of integrals: Volumes, moment of inertia.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. Textbooks: Any one of the following

- a) Jordan D. W., and Smith P., *Mathematical Techniques, An introduction for the engineering, physical and mathematical sciences; Second edition, Oxford University Press, 1997.*
- b) Kaplan W., *Advanced Calculus, Second Edition, Addison-Wesley Publishing Company, 1973.*

2. References:

- 1) Pearson Carl E. (Ed); *Handbook of applied Mathematics, Second Edition, Van Nostrand Reinhold, New York, 1990.*
- 2) *Handbook of Mathematics for Engineers and Scientists, Andrei D. Polyaniin and Alexander V. Manzhirov; Chapman and Hall/CRC; 1edition (2006),ISBN 1584885025.*
- 3) *Schaum's Outline of Advanced Mathematics for Engineers and Scientist, Murray R Spiegel, Publisher: McGraw-Hill; 1 edition, ISBN: 0070602166.*
- 4) *Advanced Engineering Mathematics with MATLAB (Bookware Companion), Thomas L. Harman, James B. Dabney, and Norman John Richert;Publisher: Cengage Engineering; 2nd edition (1999) Language:English ISBN-10: 0534371647.*

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECU 108: Introduction to the Engineering Profession

Prerequisites: Admission to an Engineering programme

Objectives

The objective of the course is to broaden the student's view of engineering and make students more powerful in their chosen careers.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Through guest lectures, gain insights into a variety of challenges faced by engineering businesses and how strategies are evolved to rise to these challenges.
2. Give short, precise talks and will improve their ability to write clearly about technical subjects.
3. Use the main terms used to discuss aspects of personality and models of motivation at work, grasp basic concepts used to classify sources of power and influence in organizations, and understand the basic concepts used in discussing and categorizing organizational cultures.
4. Analyze the success and failure of corporations in terms of their strategic position and organizational capabilities, evaluate the optimal boundaries of firm activities in terms of make or buy decisions, and understand how strategy is formulated in their future employer's firm.

Course Description

History of engineering. Infrastructural aspects of engineering. The engineer and society: safety, relationship with government, clients, and the professional team. Introductory lectures in the diverse areas of engineering offered by different departments of the School of Engineering and Technology: Electrical building services, power systems, control, telecommunications, electronics, computing, data networks & the Internet; Civil - structures, highways, water systems and other public works; and Mechanical - building services, machinery and equipment. Engineering tasks: data collection, analysis and presentation, planning, design, supervision, operation, maintenance. Reports and associated documents. Examples of engineering projects; Safety issues in and environmental impacts of engineering projects. Group work. Problem analysis, formulation of alternative solutions; preliminary design. Guest lectures and/or industrial interface addressing topics Innovation, Product Development, Multi-Disciplinary Projects and Sustainability. Communication, audience and structure; Giving presentations and making slides; Constructing text from paragraphs; Style and structure; Laboratory reports; Introduction to management; Individuals at work; Power and politics in organisations; Organisational culture; Vision and positioning; Firm boundaries and core competences; Strategy process

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% where 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. The Engineers' Act 2011, Government Printer.
2. The Building Code, GOK.
3. Conditions for Engagement, ACEK.
4. Project Management (International Edition), 2nd Edition, by Clifford F. Gray and

Eric W. Larson; Publisher - McGraw Hill

3. Journals and on-line materials (provided by KU Library)
 - a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
 - b) Ebrary, Springerlink, Data World Bank

ECV 100: Engineering Drawing I

Prerequisites: KCSE Mathematics

Objective

The objective of the course is to give the student an understanding of basic aspects of engineering drawing practice, to impart skills of engineering drawing and sketching, and to introduce the student the elements of loci and development of solids.

Expected Learning Outcomes:

By the end of this unit, the student should be able to:

1. Select and use appropriate drawing instruments for a particular drawing task.
2. Construct loci of points in mechanisms commonly encountered in mechanical engineering.
3. Make orthographic drawings given pictorial drawings.
4. Interpret orthographic drawings and make isometric and oblique drawings/sketches for given orthographic drawings.
5. Develop shapes based on interpenetration of solids or hollow sections.

Course Description

Various aspects of graphic language. Aesthetic, artistic and Technical Drawing. Drawing in relation to design and production. Technical Drawing equipment for pencil work and ink work drawing, paper size, lines, lettering, numbering and titling. Applied geometry: construction of Loci, threads, cams and gear teeth profiles. Orthographic projection of simple objects, first and third angle projections. Dimensioning. Pictorial drawing: Isometric, Oblique and perspective. Auxiliary views; true length of a line, true shape of a surface, true inclination of angles, development; interpenetration of geometric solids: curves of interpenetration. Rules of dimensioning: Kenyan standards, international standards such as ISO geometric construction such as ellipse, hyperbola, parabola.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 3 hours per week.

Assessment

Ordinary Examination at end of Semester 50%; Coursework 50%; to include assignments (30%) and continuous assessment tests (20%).

Textbook

- 1) K. Morling, Geometric and Engineering Drawing, 2007

ECV 102: Computer Programming I

Prerequisite: ECU 109: Fundamentals of Computing

Objective

The objective of the course is to enable a student to apply a high level language for solution of simple scientific problems, and for this purpose to manipulate the inputs/outputs of a computer programme.

Expected Learning Outcomes

At the end of the course a student is expected to

1. Describe the process of creation of a computer programme, and the different approaches.
2. Use on high level language to code write, compile, link and execute a programme with emphasis on scientific (engineering) applications.
3. Design implement and use a user interface for the programme.

Course Description

Program design concepts: algorithm, modular, design, program structures, flow charts pseudocode, top-down design, stepwise refinement. High level programming language such as C++ TO write programmes, commercial, oriented, scientific and special purpose. Structured programming and object oriented programming. Program compilation, compiler facilities, Linking; input/output modes, text and graphics modes. Designing user interface assemblers and interpreters.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 15% shall be continuous assessment tests and 15% shall be assignments.

Computer Laboratory Exercises

Each student is expected to carry out at least seven computer laboratory exercises prescribed by the course lecturer. These will include (a) programming project and (b) simulation work in high level language.

Textbooks and References

1. Textbooks: Any one of the following

- Introduction to Languages and Theory of Computation, John MARTIN, McGraw-Hill, 2006

2. References:

- Learn to Program with Visual Basic.Net, John SMILEY 2007, A-Press, ISBN 056678-6,
- Numerical Recipes in FORTRAN 77: The Art of Scientific Computing by William H. Press, Brian P. Flannery, Saul A. Teukolsky, and William T. Vetterling, Cambridge University Press; 1992, 2nd edition (ISBN 0521430647)
- Programming with Objects: A Comparative Presentation of Object Oriented Programming with C++ and Java by Avinash Kak, Wiley-IEEE Press, 2003
- The Fortran 2003 Handbook: The Complete Syntax, Features and Procedures; Jeanne C. Adams (Author), Walter S. Brainerd(Author), Richard A. Hendrickson, Richard E. Maine, Jeanne T. Martin, Brian T. Smith, Publisher: Springer; 1 edition (2008) ISBN 1846283787

3.2 Second Year of Study

3.2.1 First Semester

ECU 200: Engineering Mathematics V

Prerequisites: ECU 107: Engineering Mathematics IV

Objective

The objective of the course is to integrate different functions and perform numerical integration.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Apply integration to series functions.
2. Apply the integration techniques to selected engineering problems,
3. Use simple numerical integration techniques to estimate solutions to simple integration problems.
4. Apply integration to determine volumes and moments of inertia of bodies whose shapes can be described using simple functions.

Course Description

Techniques of integration: Powers of trigonometric functions; standard subscription including trigonometric and hyperbolic functions and partial fractions, integration by parts: double integrals and change of order of integration: Applications of integration: Kinematics of simple harmonic motion and oscillators, arc length, plane and surface area, and volume

in Cartesian coordinates: Mass, Moment and Centre of mass; Sequences and Series: Sequences and Convergence, Infinite series, Power series, Taylor and Maclaurin series, Binomial theorem and binomial series. L'Hopital's rule. Rolle's Theorem. Numerical integration: Euler, Trapezoidal, Mid-ordinate, and Simpson's rules.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. Textbooks: Any one of the following

- a) Jordan D. W., and Smith P., Mathematical Techniques, An introduction for the engineering, physical and mathematical sciences; Second edition, Oxford University Press, 1997.
- b) Kaplan W., Advanced Calculus, Second Edition, Addison-Wesley Publishing Company, 1973.

2. References:

- 1) Pearson Carl E. (Ed); Handbook of applied Mathematics, Second Edition, Van Nostrand Reinhold, New York, 1990.
- 2) Handbook of Mathematics for Engineers and Scientists, Andrei D. Polyinin and Alexander V. Manzhirov; Chapman and Hall/CRC; 1edition (2006),ISBN 1584885025.
- 3) Schaum's Outline of Advanced Mathematics for Engineers and Scientist, Murray R Spiegel, Publisher: McGraw-Hill; 1 edition, ISBN: 0070602166.
- 4) Advanced Engineering Mathematics with MATLAB (Bookware Companion), Thomas L. Harman, James B. Dabney, and Norman John Richert;Publisher: Cengage Engineering; 2nd edition (1999) Language:English ISBN-10: 0534371647.

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECU 201: Engineering Mathematics VI

Prerequisites: ECU 105: Engineering Mathematics II

Objective

The objective of the course is to impart the fundamental concepts of probability and

statistics.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Derive and determine key parameters used for statistical representations
2. Be able to use the statistical and probability distribution functions
3. Use simple computer programmes to simulate events which fall into a priori specified probability distribution,
4. Carry out mathematical manipulation of distribution functions to obtain functions for conditional probability and derivatives functions.

Course Description

Definition of Statistics: Data collection; Data presentation techniques, Distribution functions including, Gaussian, Binomial, Poisson, Normal, Gamma, student's and F distributions normal and distributions, ChiSquare Distribution. Sampling: Sampling errors, Estimation of population parameters. Correlation: Simple linear correlation coefficient, Regression coefficient, Forecasting, Determination coefficient. Definitions of Probability, Axiomatic Probability; Conditional, Probability and Independent Events; Bayes Theorem; Concept of Random Variable; Univariate Probability Distributions; Expected Value and Variance; Conditional Probability Distributions; Trans-formation; Probability Generating Function, Characteristic Function, Moment Generating Function; Some Special Discrete and Continuous Probability Distributions.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. Textbooks: Any one of the following

- a) Jordan D. W., and Smith P., Mathematical Techniques, An introduction for the engineering, physical and mathematical sciences; Second edition, Oxford University Press, 1997.
- b) Kaplan W., Advanced Calculus, Second Edition, Addison-Wesley Publishing Company, 1973.

2. References:

- 1) Pearson Carl E. (Ed); Handbook of applied Mathematics, Second Edition, Van Nostrand Reinhold, New York, 1990.
- 2) Handbook of Mathematics for Engineers and Scientists, Andrei D. Polyandin and Alexander V. Manzhirov; Chapman and Hall/CRC; 1edition (2006),ISBN 1584885025.
- 3) Schaum's Outline of Advanced Mathematics for Engineers and Scientist, Murray R Spiegel, Publisher: McGraw-Hill; 1 edition, ISBN: 0070602166.

- 4) Advanced Engineering Mathematics with MATLAB (Bookware Companion), Thomas L. Harman, James B. Dabney, and Norman John Richert; Publisher: Cengage Engineering; 2nd edition (1999) Language: English ISBN-10: 0534371647.
3. Journals and on-line materials (provided by KU Library)
 - a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
 - b) Ebrary, Springerlink, Data World Bank

ECV 200: Engineering Drawing II

Prerequisites: ECV 100: Engineering Drawing I

Objective

The objective of the course is to impart to the student the knowledge of principles of sectioning, dimensioning, and detailing of engineering drawings, CADD programs, piping and electrical drawings.

Expected Learning Outcomes

By the end of this unit, the student should be able to:

1. Prepare sectional views, plans and elevations and dimension them
2. Make freehand sketch of basic electrical circuits and piping drawings
3. perform intersection of planes and surfaces

Course Description

Sectional views of objects; Viewing planes. Projection of Solids. Oblique projection of planes and solids. Isometric construction. Intersection of planes. Intersection of surfaces. Development of surfaces using generators; true view, oblique view. Elements of engineering design presentation; plans, elevations, sections. Introduction to AutoCAD.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 50%; Coursework 50%: to include assignments (30%) and continuous assessment tests (20%).

Textbooks

- 1) K. Morling, Geometric and Engineering Drawing, 2007
- 2) Rhodes and Cook, Basic Engineering Drawing (2004)

ECV 201: Surveying I

Prerequisites: ECU 105: Engineering Mathematics II

Objective

The objective of the course is to introduce surveying concepts and instruments of survey for various purposes

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Undertake site survey using chain, compass and plane table instruments
2. Identify error types, sources and propagation
3. Measure differences in height.
4. Apply in preparation of site plans

Course Description

Introduction: definitions and basic concepts. Linear measurements: ranging of line, monumentation of points; instruments and tools, chains, steel bands, tapes, corrections, accuracies. Electromagnetic Distance Measurement (EDM): basic principles, uses, accuracies. Detailed surveying of direct linear measurement. Measurements of differences in heights; geometric leveling: principles, differential leveling, reciprocal leveling, procedures, leveling instruments, telescopic, leveling tube, booking, calculations, sources of errors, corrections, accuracies. Applications: contouring, methods guide, radial line, cross and longitudinal sections, site leveling. Fieldwork.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week; Laboratory Exercises: Three sessions per semester each being 3 hours long.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10 % shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at comprehensive practical exercises involving

- Chain and compass surveying
- Leveling and adjustment of levels

Textbooks and References

1. Textbook:

- 1) Wilfred Schofield and Mark Breach; Engineering surveying. Butterworth Heinemann, 2007, ISBN:0750669497
- 2) Arthur Bannister, Stanley Raymond and Raymond Baker; Surveying. Prentice Hall, 7th ed, 1998. ISBN:0582302498.

2. References

1. J. Uren and W.F. Price; Surveying for Engineers. Macmillan, 3rd ed. 1994. ISBN: 0333577051

ECV 202: Fluid Mechanics I

Prerequisites: ECU 103: Physics for Engineers II

Objective

The objective of the course is to introduce the fundamental principles of fluid statics and fluid flow kinematics.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Determine static pressure acting in a fluid
2. Determine pressure force acting on submerged and floating plane and curved surfaces
3. Develop Bernoulli's theorem equation and its practical application.
4. Determine acceleration and velocity at given point in a fluid flow

Course Description

Introduction to fluid mechanics; fluid properties, dimensions and units. Pressure gauges and manometers. Fluid statics: hydrostatic forces and centre of pressure on plane and curved surfaces. Buoyancy: Stability of submerged and floating bodies. Kinematics of flow: Types of fluid flow, continuity equation, velocity and acceleration, velocity potential function and stream function vorticity and introduction to vortex flow. Fluids subjected to uniform acceleration. Dynamics of fluid flow: equations of motion. Bernoulli's equation.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four of the experiments listed below.

1. Use of manometer for pressure measurements and measurement of the friction loss in a pipe using manometry.
2. Demonstration of the use of pitot-static tube for measurement of flow velocity.
3. Determination of the critical Reynolds number in a pipe flow.
4. Flow discharge measurement using a triangular notch

Textbook

1. Douglas J. F., Gasorick J. M., Swaeld J., Jack L.; Fluid Mechanics, 5th Edition, 2006, Prentice Hall; (ISBN-10: 0131292935 ISBN-13: 978-0131292932)
2. Journals and on-line materials (provided by KU Library)
 - a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
 - b) Ebrary, Springerlink, Data World Bank

ECV 203: Strength of Materials I

Prerequisites: ECU 103: Physics for Engineers II

Objective

The objective of the course is to introduce the fundamental principles of stress and strain and the behaviour of materials under different loading conditions.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Develop stress-strain curve for materials under loading
2. Calculate Poisson's ratio, volumetric strain and elastic constants for elastic material
3. Apply Hooke's Law
4. Describe properties of section under bending and shear stresses

Course Description

Introduction to concepts of mechanics of materials: loading; static and dynamic forces. Concept of stress and strain in tension, compression and shear: principal stresses and Mohr's circle of stresses and strain, axial stress and strain graphs, Hooke's Law, moduli of elasticity and rigidity, elastic stress-strain relationship, Poisson's ratio, volumetric stress and strain. Review of properties of sections, stresses due to bending, flexure formula. Stresses due to pure shear, shear formula. Tensile and Compressive tests.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four of the experiments listed below.

1. Determination of modulus of elasticity.
2. Determination of Poisson's ratio
3. Elongation tests.
4. Bending and re-bending tests

Textbooks and References

Textbook:

- Carl T.F. Ross, John Case and Chilver A.H; Strength of materials and structures. 4th ed., 1999, Butterworth-Heinemann. ISBN: 0340719206.

References

- Stephens R.C; Strength of Materials. 1970. Edward Arnold Publishers, London

Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 204: Theory of Structures I

Prerequisites: ECV 203: Strength of materials I

Objective

The objective of the course is to introduce the basic theory of analysis for determinate structures.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Analyze statically determinate beams under static loading
2. Analyze statically determinate pin jointed framed structures
3. Analyze statically determinate frames

Course Description

Fundamentals of statics: resultants and equilibrium of forces. Structural forms, their identification and idealization. Types of structural loads and support systems. Concepts of equilibrium: equations of equilibrium, statical determinacy and indeterminacy of various

types of structures, degrees of freedom, free-body diagrams. Analysis of statically determinate beams: shear forces, bending moments, shear force and bending moment diagrams. Analysis of statically determinate pin-jointed frame structures: method of joints, method of sections, method of tension coefficients, graphical method, force and funicular (string) polygons. Analysis of statically determinate frames: thrust forces, shear forces, bending moments, and their corresponding diagrams, deflected shapes. Three-hinged portal frames.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four experiments covering the topics listed below.

1. Measurements of elastic deformation of determinate beams
2. Measurements of elastic deformation of determinate trusses
3. Deformation in indeterminate structures

Textbooks and References

1. Textbook:
 - Theory of Structure Theory of Structures By KHURMI R.S ISBN06-017129
2. References
 - KHURMI R.S; Theory of Structure Vol. I ISBN 00-017129
 - KHURMI R.S; Theory of Structure Vol. II

ECV 205: Civil Engineering Materials I

Prerequisites: ECV 101: Material Science

Objective

The objective of the course is to impart knowledge on concrete making and quality control as well as masonry and mortar.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Make concrete of specified properties
2. Carry out concrete mix design
3. Mix, place and cure concrete

4. Use masonry materials and mortar and undertake quality control
5. Describe possible environmental effects.

Course Description

Inorganic cements types such as Portland cement, pozzolanic cement: manufacture, properties. Cement additives. Sources of cement in Kenya. Hydration of Portland cement. Natural and artificial aggregates: Types; physical, mechanical and chemical properties. Concrete technology: introduction to types, concrete-making materials: properties of fresh concrete: workability segregation, compaction breeding etc: Properties of hardened concrete, mixing, placing, and curing, mix design, destructive and non-destructive tests, quality control, durability, and special concrete. Masonry: building stone, blocks and brick types; Properties, uses, deterioration, properties of mortar; Quality control tests on masonry and mortars.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four of the experiments covering the topics listed below.

1. La Chetalier Test
2. Slump test to determine workability
3. Compaction Test
4. Non-destructive test on concrete

Textbooks and References

1. Textbook:

- Michael S. Mamlouk and John P. Zaniewski; Materials for Civil and construction Engineers. 2nd ed. 2005, Prentice Hall, ISBN:0131477145

4. Journals and on-line materials (provided by KU Library)

- c) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- d) Ebrary, Springerlink, Data World Bank

3.2.2 Second Semester

ECU 202: Engineering Mathematics VII

Prerequisites: ECU 200: Engineering Mathematics V

Objective

The objective of the course is to impart knowledge on solution and applications of First and higher order differential equations.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Solve First order first degree differential equations
2. Apply the equations to geometrical problems involving curves, surfaces and trajectories
3. Solve higher order linear differential equations and apply these Laplace, Poisson, heat and wave equations.
4. Solve a simple system of differential equations.

Course Description

Differential Equations and their Solutions: First Order and First Degree Differential Equations: Exact differential equations and integrating factors; Separable and homogeneous equations, Linear equations: Applications of First Order and First Degree Differential Equations: Geometrical problems, Surfaces and curves in three dimensions, Orthogonal trajectories, Oblique trajectories. Higher Order Linear Differential Equations and Applications: Second order linear equations, characteristic equation and complex roots; non-linear equations and separation of variables; Laplace, Poisson, heat and wave equations, methods of the solution by separation of the variables for Cartesian, spherical polar and cylindrical polar coordinates: Linear Systems of Differential Equations.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. Textbooks: Any one of the following

- a) Jordan D. W., and Smith P., Mathematical Techniques, An introduction for the engineering, physical and mathematical sciences; Second edition, Oxford University Press, 1997.
- b) Kaplan W., Advanced Calculus, Second Edition, Addison-Wesley Publishing Company, 1973.

2. References:

- 1) Pearson Carl E. (Ed); Handbook of applied Mathematics, Second Edition, Van

- Nostrand Reinhold, New York, 1990.
- 2) Handbook of Mathematics for Engineers and Scientists, Andrei D. Polyaniin and Alexander V. Manzhirov; Chapman and Hall/CRC; 1edition (2006),ISBN 1584885025.
 - 3) Schaum's Outline of Advanced Mathematics for Engineers and Scientist, Murray R Spiegel, Publisher: McGraw-Hill; 1 edition, ISBN: 0070602166.
 - 4) Advanced Engineering Mathematics with MATLAB (Bookware Companion), Thomas L. Harman, James B. Dabney, and Norman John Richert;Publisher: Cengage Engineering; 2nd edition (1999) Language:English ISBN-10: 0534371647.

ECU 203: Engineering Mathematic; VIII

Prerequisite; ECU 200: Engineering Mathematics V

Objective

The objective of the course is to equip students with skills to use common transform methods in engineering.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

- a) Describe the laplace transforms properties and transform
- b) Solve the fourier series equations and fourier transform properties,
- c) Apply Laplace and Fourier transform to the solution of differential equations
- d) Use additional functions commonly used in engineering.
- e) Carry out transforms of powers, exponentials and trigonometric functions
- f) Carry out inverse transforms

Course Description

Laplace Transform: Definitions and notation; transforms of powers, exponential and trigonometric functions; scales, shift and factors rules; inverse transforms, application to Heaviside and Delta functions and solution of differential equations; Transfer functions, convolution theorem and discrete systems: Fourier series: Periodic functions, including sine and cosine series, determination of coefficients, even and odd functions: Fourier Transform (FT) and non-periodic functions: Properties of FT and Transform rules including on differentiation, convolution theorem, delta and Dirac functions: Solutions of Differential Equations by Laplace Transform and Fourier: Special functions: Bessel functions, Legendre Polynomials; Gamma functions.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 20% shall be continuous assessment tests and 10% shall be assignments.

Textbook; and References

1. Textbooks: Any one of the following

- a) Jordan D. W., and Smith P., *Mathematical Techniques, An introduction for the engineering, physical and mathematical sciences; Second edition*, Oxford University Press, 1997.
- b) Kaplan W., *Advanced Calculus, Second Edition*, Addison-Wesley Publishing Company, 1973.

2. References:

- 1) Pearson Carl E. (Ed); *Handbook of applied Mathematics, Second Edition*, Van Nostrand Reinhold, New York, 1990.
- 2) *Handbook of Mathematics for Engineers and Scientists*, Andrei D. Polyinin and Alexander V. Manzhirov; Chapman and Hall/CRC; 1edition (2006), ISBN 1584885025.
- 3) *Schaum's Outline of Advanced Mathematics for Engineers and Scientist*, Murray R Spiegel, Publisher: McGraw-Hill; 1 edition, ISBN: 0070602166.
- 4) *Advanced Engineering Mathematics with MATLAB (Bookware Companion)*, Thomas L. Harman, James B. Dabney, and Norman John Richert; Publisher: Cengage Engineering; 2nd edition (1999) Language:English ISBN-10: 0534371647.

ECV 206: Surveying II

Prerequisites: ECV 201: Surveying I

Objective

The objective of the course is to impart knowledge on the use of a level and a theodolite to produce a survey plan with profiles and enable computation of volumes and mass haul.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Use a level and theodolite to produce a survey plan
2. Identify error types sources and propagation
3. Make cross-sections and profile for drainage and highways

Course Description

Angular measurements by Theodolite: horizontal and vertical angles, errors and accuracies. Methods of point fixation: design, order, observations, computations, errors and accuracies of traverses triangulation, trilateration, trigonometric leveling, intersection, resection and combination of methods. Tacheometry: principles of optical distance measurements, stadia method, field procedures and booking. Differences in heights, instruments, reductions, plane table surveying. Field work.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10%

shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct the experiments listed below.

- Adjustment of levels and theodolite
- Leveling and tachometry and traversing.
- Plotting contours, profiles and sections

Textbooks and References

1. Textbook:

- Wilfred Schofield and Mark Breach; Engineering surveying. Butterworth-Heinemann, 2007, ISBN:0750669497
- Arthur Bannister, Stanley Raymond and Raymond Baker; Surveying. Prentice Hall, 7th ed, 1998. ISBN:0582302498

2. References

- J. Uren and W.F. Price; Surveying for Engineers. Macmillan, 3rd ed. 1994. ISBN: 0333577051
- James Anderson & Mikhail Edward; Surveying: Theory and Practice. McGraw-Hill, 7th ed. 1997. ISBN:007159149

ECV 207: Fluid Mechanics II

Prerequisites: ECV 202: Fluid Mechanics I

Objective

The objective of the course is to introduce fundamental principles of flow resistance and its application in pipe flow.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Apply Bernoulli equation in flow measurement devices.
2. Determine conditions of turbulent/laminar flow
3. Develop Bernoulli's theorem and its practical application
4. Develop momentum theorem and understand its practical applications

Course Description

Practical application of Bernoulli's equation. Momentum equation and its application. Orifices and mouthpieces. Time to empty tanks. Viscous flow: Turbulent flow, Moody's resistance diagram, introduction to boundary layer theory, Flow through pipes empirical equations for frictional head losses, and loss of energy in pipes. Power transmission through pipes and nozzles Pipes networks. Water hammer and surge tanks. Flow control/measurement devices: notches, weirs, spillways; culverts. Dimensional and model analysis.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10 % shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four experiments based on the titles listed below.

- Determination of pressure losses in a network of pipes
- Demonstration of the use of water hammer in hydraulic ram pump, and performance characteristics determination.
- Determination of the surface profile of a free and a forced vortex.
- Determination of the total free and forced vortex.

Textbook

- Douglas J. F., Gasoriek J. M., Swaffield J., Jack L.; Fluid Mechanics, 5th Edition, 2006, Prentice Hall; (ISBN-10: 0131292935 ISBN-13: 978-0131292932)

Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 208: Strength of Materials II

Prerequisite: ECV 203: Strength of materials I

Objective

The objective of the course is to impart knowledge on behavior of beams under bending and axial stresses

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Determine bending stresses in regular composite sections
2. Check stability of retaining wall
3. Understand Euler law and stress
4. Understand performance of composite materials

Course Description

Bending stresses in composite sections; timber-steel, steel-concrete. Combined bending and axial stresses. Stability of retaining walls. Torsion of prismatic circular bars. Elastic buckling of struts: Euler load and stress. Introduction to empirical column equations. Southwell plot, Perry Robertson formula. Theories of failure. Performance of composite materials.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four of the experiments listed below.

1. Demonstration of Euler's formula for columns.
2. Study of the deflection of simple struts and ties.
3. Study of bending due to loading of simply supported beams.
4. Study of the deflection of members of a truss upon loading.

Textbooks and References

1. Textbook:

- Carl T.F. Ross, John Case and Chilver A.H; Strength of materials and structures. 4th ed.,1999, Butterworth-Heinmann. ISBN: 0340719206.

2. References

- Stephens R.C; Strength of Materials. 1970. Edward Arnold Publishers, London

ECV 209: Theory of Structures II

Prerequisites: ECV 204: Theory of structures I

Objective

The objective of the course is to introduce the basic theory of analysis for determinate structures.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Analyze statically determinate structures under static loading
2. Use influence lines in determinate structures
3. Draw deflected curve for loaded structure.

Course Description

Introduction to cables and determinate arches systems: types, methods of analysis and

applications. Influence line diagrams for determinate beams, trusses and arches. Determination of elastic deformations for determinate beams and trusses: moment-curvature relationship, differential equation of flexure, Double integration method, Macaulays method, Williot-Mohr diagrams. Analysis of statically indeterminate beams and frames: Three-moment theorem (Clapyron's method), method of consistent deformations, principle of superposition. Influence lines for indeterminate structures.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four experiments covering the topics listed below.

1. Measurements of elastic deformation of determinate beams
2. Measurements of elastic deformation of determinate trusses
3. Deformation in indeterminate structures

Textbook; and References

1. Textbook:
 - Theory of Structure Theory of Structures By KHURMI R.S ISBN 06-017129
2. References
 - KHURMI R.S; Theory of Structure Vol. I ISBN 00-017129
 - KHURMI R.S; Theory of Structure Vol. II
3. Journals and on-line materials (provided by KU Library)
 - a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
 - b) Ebrary, Springerlink, Data World Bank

ECV 210: Civil Engineering Materials II

Prerequisites: ECV 205: Civil Engineering Materials I

Objective

The objective of the course is to equip the student with knowledge of the engineering properties and manufacturing properties of commonly used engineering materials and response to typical environment conditions.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. State the properties of steel, aluminium and alloys, copper and alloys and
2. Select the right metal material for specific use
3. Explain the properties of timber, preservation methods and strength
4. Explain the manufacturing process of polymers and ceramics, their properties and uses
5. Explain the behaviour of composites.

Course Description

Metals : definition. Properties; physical, chemical and mechanical. Manufacture of iron. Corrosion of metals and protection uses. Aluminium and its alloys; corrosion of metals and protection. Wood and Timber: properties of wood, moisture variations, seasoning, defects, preservations, fire resistance, durability, strength, permissible stresses of timber. Polymers: definition, raw materials and chemical structure. manufacture, types, structure, properties and uses. Ceramics: definition manufacture, types, properties and uses. Manufacture; raw materials and processes. Corrosion; types and prevention. Composites.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct the four experiments listed below.

- Compressive strength tests on timber portion
- Moisture content determination on timber portion
- Tensile tests on timber portions
- Deflection tests on timber portions

Textbooks and References

1. Textbook:

- Michael S. Mamlouk and John P. Zaniewski; Materials for Civil and construction Engineers. 2nd ed. 2005, Prentice Hall, ISBN:0131477145

2. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 211: Electromechanical Engineering

Pre requisite: ECV 102: Engineering Physics II

Objective

The objective of this course is assist the civil engineering student to provide for electrical and mechanical services

Expected Learning Outcomes:

At the end of the course the student should be able to:

1. Describe current, voltage and resistance.
2. Differentiate between alternating and direct current.
3. Describe single phase and three phase alternating current.
4. Carry out electrical installation.
5. Design for fire protection.
6. Design for mechanical systems e.g. pumps lifts etc

Course Description

Current, voltage and resistance. Power sources. Electric power. Joule's law. Series and parallel circuits. Ohm's, and Kirchhoff's laws. Direct Current (D.C.) circuit analysis. Alternating voltage and current. Impedance and admittance. Single phase A.C. circuits. Three-phase alternating current. Electrical measurements and measuring instruments. Electrical installation; wiring facilities and ducting. Fire protection: means of escape, fire regulations, grading, resistance, fire detection and fighting facilities. Refuse disposal systems: Chutes, incinerator, garchery systems, macerator equipment. Solid waste and soil drainage disposal. Mechanical systems, pumps sizes and location. Provision of specialized services such as lifts, excavators and ventilation, air conditioning and refrigeration.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct the four experiments listed below.

The practical work/laboratory exercises are to cover the following topics

- a) Speed control of different types of electrical machines
- b) Principles of voltage stepping down
- c) Design and draw an electrical installation for a small building
- d) Carryout electrical installation in buildings.

Textbooks and References

1. Electrical and Electronic Technology, Edward Hughes, Publisher: Pearson Prentice Hall; 10th edition (June 2008) ISBN-10: 0132060116

ECV 212: Internal Practical Training (12 weeks)

Prerequisites: ECV 200: Engineering Drawing II, ECV 201: Surveying I, ECV 210: Civil Engineering Materials II, ECV 211: Electrical Engineering, ECV 208: Strength of Materials II, ECV 209: Theory of structures II

Objective

The objective of the course is to provide a student with hands on experience on shop floor practices in the key areas of civil and mechanical engineering.

Expected Learning Outcomes

At the end of the course a student will be expected to be able to:

1. Make simple sheet metal products using hand tools, sheet bending and cutting machines
2. Use on his own a lathe machine for turning, milling machine for preparation of surfaces, , a radial drilling machine
3. Use on his own a wood working machines,
4. Make joints of timber sections
5. Produce from design drawings, production drawings and hence simple parts requiring use of machine tools
6. Prepare a mold for sand casting
7. Thread pipes and pipe fittings and assemble typical plumbing works
8. Prepare mortar and use it for a pavement slab construction, or erection of a stone wall
9. Assess the degree of wear of selected components of fluid flow machinery
10. Make simple welded joints.

Course Description

This will be for eight (12) weeks at the end of their second year of study. The students will follow an approved practical training schedule designed by the department. The schedule will cover training on safety, practical exercises on use of machine tools, fitting and hand tools, welding and joinery-including soldering brazing, arc and gas welding-plumbing, masonry, carpentry, automotive engineering, and foundry. Practical exercises on other

production processes may be added.

Mode of Delivery

Lectures: 35 hours per week of practical exercises and 5 hours per week for tutorials and discussions.

Log Book

The student will be required to daily fill a log book which will be signed by the technician in charge of the workshop where the exercises are offered and marked by a lecturer at the end of every week. The lecturer will also assess the products made by the students. Marks distribution will follow departmental guidelines/format for the different projects. The course will be assigned on a pass or fail basis.

Assessment

Assessment will be based on a student's logbooks and reports by University lecturers.

3.3 Third Year of Study

3.3.1 First Semester

ECU 300: Engineering Mathematics IX

Prerequisites: ECU 200: Engineering Mathematics V

Objective

The objective of the course is to impart knowledge on partial differential equations and their integration, vector functions and differentiation, vector fields and vector calculus.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Establish continuity of functions, and be able to derive the limits of functions,
2. Solve partial differential equations for functions of several variables including vector functions in 3-D space, and apply the equations to determination of extreme points.
3. Integrate partial differential equations
4. Express and manipulate partial differential equations in vector form.

Course Description

Vectors and Coordinate Geometry in 3-D Space. Vector Functions and Curves. Functions of Several Variables and Partial Differentiation and its applications. Multiple integration: Double integrals, Triple integrals, Applications of multiple integrals. Vector fields: Scalar and Vector Fields, Conservative Fields, Line Integrals of Vector Fields, Surface and Surface Integrals. Vector Calculus: Gradient, Divergence, Curl. Green's Theorem, The Divergence Theorem, Stoke's Theorem; curvilinear coordinates in two and three dimensions.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. Textbooks: Any one of the following

- a) Jordan D. W., and Smith P., *Mathematical Techniques, An introduction for the engineering, physical and mathematical sciences; Second edition, Oxford University Press, 1997.*
- b) Kaplan W., *Advanced Calculus, Second Edition, Addison-Wesley Publishing Company, 1973.*

2. References:

- 1) Pearson Carl E. (Ed); *Handbook of applied Mathematics, Second Edition, Van Nostrand Reinhold, New York, 1990.*
- 2) *Handbook of Mathematics for Engineers and Scientists, Andrei D. Polyandin and Alexander V. Manzhirov; Chapman and Hall/CRC; 1edition (2006),ISBN 1584885025.*
- 3) *Schaum's Outline of Advanced Mathematics for Engineers and Scientist, Murray R Spiegel, Publisher: McGraw-Hill; 1 edition, ISBN: 0070602166.*
- 4) *Advanced Engineering Mathematics with MATLAB (Bookware Companion), Thomas L. Harman, James B. Dabney, and Norman John Richert;Publisher: Cengage Engineering; 2nd edition (1999) Language:English ISBN-10: 0534371647.*

ECV 300: Engineering Geology

Prerequisites: ECU 103: Physics for Engineers II

Objective

The objective of the course is to impart knowledge in rock formations and their characteristics and methods of site investigations.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Identify different rocks and describe the formation process
2. Describe types and factors affecting weathering
3. Interpret geological features in aerial photos and maps
4. Use various methods of geological site investigation
5. Explain earth movement and earthquake.

Course Description

Introduction to geology and its relevance to civil engineering. Mineralogy: composition, properties and nature of minerals. Petrology: nature and types of rocks, rock sampling, rock properties, classification. Structural geology: folds, faults and joints, slope stability, failure

causes in natural and manmade slopes, types of failures. Weathering: types and factors affecting weathering. Site investigations: objectives and methods of site investigations. Quarrying: composition, methods of quarrying and safety precautions. Engineering seismology: effects of earthquakes. Geological maps: outcrops, strikelines, and angles of dip. Site investigations: ground investigation, laboratory investigation, sample and sampling. Quarrying: surface and underground excavation, rock reinforcing. Geological maps: map interpretation, field mapping. Laboratory work.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four practical exercises involving

1. Identification of different rock formations in the field.

Textbook

1. F.G. Bell; Engineering Geology. Butterworth–Heinmman, 2nd ed., 2007. ISBN:0750680776

ECV 301: Soil Mechanics I

Prerequisites: ECU 103: Physics for Engineers II

Objective

The objective of the course is to introduce the basic properties of soil and its permeability.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Classify soils through sieve analysis plasticity limits
2. Determine the coefficient of permeability and compute seepage discharge
3. Describe Darcy's law.
4. Use the principle of consolidation to calculate settlement

Course Description

Role of soil mechanics in civil engineering, origin and formation of soils. Soil Structure and Clay mineralogy: Clay-Water Forces, Inter particle Forces, Fabric. Phase relationships and Index Properties: water content, specific gravity, sieve and hydrometer analysis, Atterberg limits, volumetric and linear shrinkage. Soil Classification: Textural classification, Unified Soil Classification System. Compaction: Compaction theory, lab and field compaction, control methods, Specifications for field compaction, Permeability & seepage: Soil water:- adsorbed

and capillary water. Darcy's law and soil permeability, test wells, sand drains, flownets, piping, flow beneath a retaining wall, seepage through an earth dam, critical hydraulic gradient. Effective stress, stress distribution in soils.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10 % shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four of the experiments listed below.

1. Sieve analysis for size distribution
2. Atterberg limits for plasticity
3. Dynamic compaction
4. Permeability test
5. Oedometer test

Textbook

1. Craig, R.F.; Soil Mechanics. 7th ed. 2004, Taylor and Francis, ISBN: 0415327032

ECV 302: Hydraulics I

Prerequisites: ECV 207: Fluid Mechanics II

Objective

The objective of the course is to impart knowledge on open channel flow characteristics as governed by the energy and momentum principles.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Define open channel flow and classify
2. Develop theoretical discharge formula and useful empirical formulae
3. Apply specific energy and critical flow conditions
4. Compute the surface profile of a gradually varied flow

Course Description

Flow in open channels: Classification, steady and unsteady, Steady uniform: Empirical formulae for discharge, economic sections. Steady non-uniform: specific energy, critical flow and its application in flow measurement; critical flow measurement devices (structures), design and installation. Momentum concept: specific force function, flow force, hydraulic jump and its applications. Gradually varied flow: surface profiles and types. Method of

profile analysis. Unsteady non-uniform: basic practical examples.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10 % shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct the following experiments listed below.

1. Gradually varied flow profile
2. Hydraulic jump
3. Broad-crested flow measurement.

Textbook

1. R.E. Featherstone & C. Nalluri; Civil Engineering Hydraulics. Wiley BlackWell, 1995. ISBN: 06322038632

2. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 303: Public Health Engineering I

Prerequisites: ECV 302: Hydraulics I

Objective

The objective of the course is to impart knowledge on sources of water and water treatment processes.

Expected Learning Outcomes

At the end of the course, the student should be able to:

1. Identify sources of water
2. Describe rain water harvesting
3. Describe different water treatment processes
4. Describe methods of disinfection of water
5. Design water storage facilities

Course Description

Sources of water: Rain, surface and ground. Introduction to rain water collection: Location, size construction Intake works: Types, classification- reservoir, river and canal Water

treatment unit processes: screening, coagulation, flocculation, sedimentation Filtration, aeration Disinfection methods of water: heat, ozone, ultraviolet light and chlorination Water softening and conditioning methods. Iron and manganese removal methods from Water supply and waste water disposal: pipeline profile, pipe network details, fitting details, connections and intake works.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct the four experiments listed below.

1. Physiochemical testing of water – conductivity, turbidity, pH, suspended solids
2. Chemical analysis of drinking water - alkalinity & acidity, chloride residual and demand, fluoride, iron, ammonia, manganese, jar test
3. Design studio for water storage facilities
4. Field work

Textbooks and References

1. Textbook:

- (a) George Tchobanoglous, Franklin L. Burton and H. David Stensel; Wastewater Engineering: Treatment and Reuse. McGraw-Hill, 4th ed., 2002.

2. References

- (a) Wastewater Engineering. McGraw-Hill, 4th ed., 2002. ISBN:0077124140X

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 304: Surveying III

Prerequisites: ECV 206: Surveying II

Objective

The objective of the course is to impart knowledge on computation of volume and mass haul.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Make traverse computations and earth work volumes and mass haulage
2. Learn application on adjustment of observations
3. Design, compute and set out horizontal and vertical curves

Course Description

Computations methods of areas: regular and irregular shapes, planimeter, Trapezoidal and Simpsons methods, accuracies. Computation of volumes: Trapezoidal, mid-area methods, accuracy. Mass haul diagram: construction, properties, applications. Applications on adjustment of observations: repeated measurements, leveling networks, triangulation networks. Curves: design computations and setting out of horizontal (simple, compound and transition) and vertical curves. Field work.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct the experiments listed below.

1. Adjustment of levels and theodolite
2. Leveling and tachometry and traversing.
3. Profile and cross section
4. Volumes of earthwork measured on existing cuts and fills

Textbooks and References

1. Textbook:

- (a) Wilfred Schofield and Mark Breach; Engineering surveying. Butterworth-Heinemann, 2007, ISBN:0750669497
- (b) Arthur Bannister, Stanley Raymond and Raymond Baker; Surveying. Prentice Hall, 7th ed, 1998. ISBN:0582302498

2. References

- (a) J. Uren and W.F. Price; Surveying for Engineers. Macmillan, 3rd ed. 1994. ISBN: 0333577051
- (b) James Anderson & Mikhail Edward; Surveying: Theory and Practice. McGraw-Hill, 7th ed. 1997. ISBN:007159149

ECV 305: Theory of Structures III

Prerequisites: ECV 209: Theory of Structures II

Objective

The objective of the course is to introduce the basic theory of analysis for statically determinate and indeterminate structures.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Analyze statically determinate and indeterminate structures under static loading
2. Use influence lines in indeterminate structures
3. Apply energy principles to structural analysis.

Course Description

Statically indeterminate structures: analysis by slope deflection method, moment distribution method. Elastic deformations in indeterminate structures; Conjugate-Beam Method, Moment Area method. Energy principles: strain energy, complimentary and strain energy theorems (Engesser and Castigliano's theorems), principal of virtual work and energy theorems, Application of the Principle of Virtual Work and Energy theorems in the analysis of determinate and indeterminate structures: unit load method, least work method. Indeterminate arches.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week;

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Textbooks and References

1. Textbook:

(a) Theory of Structure Theory of Structures By KHURMI R.S ISBN 06-017129

2. References

(a) KHURMI R.S; Theory of Structure Vol. I ISBN 00-017129

(b) KHURMI R.S; Theory of Structure Vol. II.

(c) HIBBELER, R.C. (2009). Structural Analysis. Upper Saddle River, NJ: Pearson.

ECV 306: Transportation Planning and Development

Prerequisites: ECU 201: Engineering Mathematics VI

Objective

The objective of the course is to introduce the basic highway and transportation planning

and sustainable transportation.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Describe transport system and classification of transport facilities
2. List different types of transportation systems
3. Describe sustainable transportation
4. Demonstrate a Plan of transportation facilities

Course Description

Introduction to highway and transportation planning: the transport system, classification of transportation facilities. Route location. The evolution of transportation system: the rail roads, mass transportation, highways and aviation. Sustainable transportation; energy demand, space requirements, non motorized transport system, pollution effects and accidents and road safety. Regulations, financing, and planning of transportation facilities.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct practical exercises involving

1. Determination of traffic volume on a section of a road
2. Acquisition and analysis of accident data.

Textbooks and References

1. Textbook:

- (a) Rogers P. Roess; Traffic Engineering. Prentice Hall, 3rd ed. 2004.
ISBN:0130812935

2. References

- (a) Nicholas J. Garber & Lester A. Hoel; Traffic and Highway engineering.
Cengage-Engineering, 2001

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

3.3.2 Second Semester

ECU 301: Engineering Mathematics X

Prerequisites: ECU 200: Engineering Mathematics V

Objective

The objective of the course is to equip a student with basic numerical techniques and procedures for obtaining approximate solution to engineering problems.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Identify sources of errors and their magnitudes and effects on engineering calculations
2. Perform interpolation and numerical differentiation using various techniques.
3. Perform numerical integration using various techniques
4. Use numerical tools, including write simple computer programmes, to obtain approximate solutions to differential equations.

Course Description

Interpolation: finite difference, linear, quadratic and lagrange methods and their applications in numerical differentiation. Newton-Raphson formula for obtaining an approximate root of an equation. Numerical integration; trapezoidal and Simpson's rules, Newton-cotes and Romberg formulae, and Gaussian quadrature. Numerical solution of ordinary differential equations; Taylor's series, Euler, Runge- Kutta, Milne, predictor-corrector and extrapolation methods.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. Textbooks:

- (a) Numerical Methods for Scientific and Engineering Computation by Iyengar S. R. K., Jain Rajendra, Jain M. K, John Wiley and Sons, 1985.
- (b) NUMERICAL METHODS: Using Matlab by John H. Mathews and Kurtis D. Fink, Prentice Hall, 2004

2. References:

- (a) Burden R. L., Faires J. D., Numerical Analysis; 8th edition Publisher: Brooks Cole; (2004) Language: (ISBN-10: 0534392008|ISBN-13: 978-0534392000)
- (b) Numerical Methods Vadamurthy V.N., Iyengar N.; Sangam Books, 1998
- (c) Numerical Methods for Engineering Applications, 2nd Edition, Joel H. Ferziger, 1998
- (d) Numerical Methods: Problems and Solutions by Jain, Mahinder Kumar, Iyengar,

- S.R.K., New Age International Publishers, 2004
(e) Numerical Analysis by Richard L. Burden, J. Douglas Faires "Brooks Cole; 2000
(f) Schaum's Outline of Numerical Analysis by Francis Scheid McGraw-Hill; 1989.

Additional References for all Mathematics Course units

- (a) Pearson Carl E. (Ed); Handbook of applied Mathematics, Second Edition, Van Nostrand Reinhold, New York, 1990.
(b) Handbook of Mathematics for Engineers and Scientists, Andrei D. Polyenin and Alexander V. Manzhirov; Chapman and Hall/CRC; 1 edition (2006), ISBN 1585685025.
(c) Schaum's Outline of Advanced Mathematics for Engineers and Scientist, Murray R Spiegel, Publisher: McGraw-Hill; 1 edition, ISBN:0070602166
(d) Advanced Engineering Mathematics with MATLAB (Bookware Companion), Thomas L. Harman, James B. Dabney, and Norman JohnRichert;Publisher: Cengage-Engineering; 2nd edition (1999) Language: English ISBN-10: 0534371647

ECU 302: Innovation and Entrepreneurship for Engineers

Prerequisites:

Objective

The objective of the course is to impart student on knowledge of setting up small business.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Describe characteristics of entrepreneurship
2. Draft a small business plan
3. List integrities' of managing a small business
4. Differentiate successful and unsuccessful business

Course Description

Definition of Innovation. Categories and types of innovation. Dimensions of strategic innovation. The innovation process. Innovation Model. Best practices for innovation success. Definition of entrepreneurship, Types of entrepreneurs, characteristics of Entrepreneurs. Role of entrepreneurs in economic development. Various sources of business opportunities. Identification of commercially viable business propositions. Business plan formulation. Sources of funding. Government policies on small business ventures, enterprising opportunities; Motivation, competencies and skills. Starting new business ventures; Business planning, Resource managements, organization development and management financial management and planning. Marketing, selling and negotiation techniques. Exit options for Engineers.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70% Continuous Assessment: 30% where 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

- (a) Project Management: A Systems Approach to Planning, Scheduling, and controlling by Harold Kerzner; Wiley; 9 edition (2005), ISBN: 0471741876
- (b) Absolute Beginner's Guide to Project Management, Greg Horine, Publisher: Que (2005) ISBN: 0789731975
- (c) Fundamentals of Project Management, James P. Lewis, Publisher: AMACOM; 3rd edition (2006); ISBN: 0814408796
- (d) Diffusion of Innovations, Rodgers

ECV 307: Hydrology I

Prerequisites: KCSE

Objective

The objective of the course is to introduce the fundamental principles of hydrological cycle and related processes that determine the water circulation in the universe.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Present the global water and energy cycles and related subsystems
2. Explain the hydrological processes application in water balance relationships
3. Carry out measurement of precipitation.

Course Description

Hydrological cycle. Precipitation: types, measurement and averaging real precipitation. Rainfall data analysis, Evaporation and transpiration: factors and methods of computation. Runoff: factors affecting runoff, flow measurements and rating curves. Zones, infiltration, percolation, permeability.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70 %; Continuous Assessment 30 % of which: 10 % shall be continuous assessment tests and 5 % shall be assignments and 15 % shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four experiments covering observation and recording of weather station data.

Textbooks and References

1. Textbook:

(a) George M. Hornberger, Je_ P. Ra_enspernger, Patricia L. Wiberg, and Keith N. Eshleman; Elements of Physical hydrology. 1998, John Hopkins Univer. Press, 0801858577

2. References

(a) Kenneth N. Brooks, Peter F. Ffolliott, Han M. Gregersen and Leonard F. DeBano; Hydrology and the management of watersheds. 3rd ed. 1991, Wiley BlackWell, ISBN:0813829852

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 308: Soil Mechanics II

Prerequisites: ECV 301: Soil Mechanics I

Objective

The objective of the course is to equip the student with knowledge on soil stresses, behavior of drained and undrained soils and soil stabilization methods.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Compute soil principle stresses
2. Determine the coefficient of consolidation
3. Compute slope stability analysis
4. State mechanical and chemical methods of soil stabilization
5. Perform field investigation of soils
6. Describe geotextiles and Geo-membranes

Course Description

Shear strength: principal planes and stresses, Mohr's circle. Mohr-Coulomb failure theory. Direct and triaxial shear strength tests: Drained and undrained shear, consolidated and unconsolidated shear testing. Stress paths. Slope Stability: stress and stability analysis:-Infinite and finite slopes, Stability number method, Method of slices. Soil stabilization: mechanical, chemical, cement, lime, bitumen, electrical, heating. Site investigations: Planning, reconnaissance, geological information, sampling, field tests, sub-surface exploration.

Environmental Geotechnology: Landfill Liners; Geosynthetics, Geotextiles, Geomembranes, and Geonets. All related Laboratory and field tests.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least three experiments covering the topics listed below.

1. Drained and Undrained Triaxial test
2. California Bearing Ratio (CBR)
3. Unconfined compression strength (UCS)

Textbook

1. Craig, R,F; Soil Mechanics. 7th ed. 2004, Taylor and Francis, ISBN: 0415327032

- a) Journals and on-line materials (provided by KU Library)
 - e) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
 - f) Ebrary, Springerlink, Data World Bank

ECV 309: Hydraulics II

Prerequisite: ECV 302: Hydraulics I

Objective

The objective of the course is to impart important knowledge on the use and application of hydraulic pumps and turbines.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Define and classify hydraulic machines
2. Describe basic design principles of pumps and turbines
3. Use basic equation of wave motion
4. Describe basic hydraulics of coastal engineering

Course Description

Hydraulic machinery: Types. Pumps and turbines: types, basic design principles, and performance characteristics. Basic equation of wave motion, small amplitude wave theory and wave transformations. Coastal engineering: hydraulics in coastal development and conservation.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four experiments covering the following topics.

1. Centrifugal pump performance characteristic curve
2. Pelton turbine load variation
3. Francis turbine performance characteristics.

Textbook

(a) Douglas J. F., Gasoriek J. M., Swaeld J., Jack L.; Fluid Mechanics, 5th Edition, 2006, Prentice Hall; (ISBN-10: 0131292935 ISBN-13: 978- 0131292932

Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 310: Public Health Engineering II

Prerequisite: ECV 303: Public Health Engineering I

Objective

The objective of the course is to impart knowledge on characteristic of wastewater

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Identify sources of wastewater
2. State physical, chemical and biological characteristics of wastewater
3. Describe methods of collection and conveyance of wastewater
4. Identify processes relevant for treatment of wastewater
5. Describe effect of wastewater on humans

6. Select an appropriate sewer system for specified conditions

Course Description

Sources of waste water: Domestic, Industrial and Agricultural. Waste water characteristics; physical, chemical and biological. Waste water collection and conveyance: methods and appurtenances. Waste water treatment and disposal; methods for small communities-pit latrines, septic tanks, cesspools, soakage pits. Waterborne diseases; types, transmission and prevention.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct the four experiments listed below.

5. Determination of wastewater organic load by BOD, COD, TDS, Nitrates and Ammonia tests
6. Determination of wastewater pathogenic load by faecal coliform test
7. Determination of helminth count
8. Field estimation of wastewater quantity from a community or housing estate.

Textbooks and References

1. Textbook:

- (a) George Tchobanoglous, Franklin L. Burton and H. David Stensel;
Wastewater Engineering: Treatment and Reuse. McGraw-Hill, 4th ed., 2002.

2. References

- (a) Wastewater Engineering. McGraw-Hill, 4th ed., 2002. ISBN:0077124140X

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 311: Surveying IV

Prerequisites: ECV 304: Surveying III

Objective

The objective of the course is to impart knowledge on photography and its interpretation.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Describe aerial photography
2. Interpret photographs
3. Perform basic photograph geometry
4. Apply photography in civil engineering design

Course Description

Aerial photography: aerial cameras, scale of photography, stereoscopy, heights from photographs, parallax bar, flight planning, applications. Photo interpretation: principles, image properties, applications. Hydrographic surveying and underground surveying. Basic geometry of the photograph: construction of the photogrammetric model, interior, relative and absolute orientations, plotting instruments, compilation of details and contour lines. Analytical approach: Basic concepts of aerial triangulation, principles of digital photogrammetric systems. Applications in Civil Engineering Practices.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct the experiments listed below.

1. Interpret aerial photographs and interpret various features

Textbooks and References

1. Textbook:

- (a) Wilfred Schofield and Mark Breach; Engineering surveying. Butterworth-Heinemann, 2007, ISBN:0750669497
- (b) Arthur Bannister, Stanley Raymond and Raymond Baker; Surveying. Prentice Hall, 7th ed, 1998. ISBN:0582302498

2. References

- (a) J. Uren and W.F. Price; Surveying for Engineers. Macmillan, 3rd ed. 1994. ISBN: 0333577051
- (b) James Anderson & Mikhail Edward; Surveying: Theory and Practice. McGraw-Hill,

ECV 312: Theory of Structures IV

Prerequisites: ECV 305: Theory of structures III

Objective

The objective of the course is to impart knowledge of structural analysis.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Analyze structures using matrix methods
2. Apply finite element method in structural analysis

Course Description

Matrix methods of analysis of structures: Stiffness and flexibility (force) methods for analysis of beams, frames and trusses. Introduction to finite element methods and application in Structural Analysis.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week;

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Textbooks and References

1. Textbook:

(b) Theory of Structure Theory of Structures By KHURMI R.S ISBN 06-017129

2. References

(a) KHURMI R.S; Theory of Structure Vol. I ISBN 00-017129

(b) KHURMI R.S; Theory of Structure Vol. II.

ECU 303: Industrial Practical Attachment I (12 weeks)

Prerequisites: ECV 212: Practical Attachment – Internal

Objective

The objective of the course is to provide a student with exposure to actual engineering practices and processes in the industry whose operations are relevant to the programme of study.

Expected Learning Outcomes

At the end of the course a student will be expected to be able to:

1. Describe, design and operate equipment he/she is exposed to in a water or civil engineering plant
2. Describe the maintenance of equipment exposed to in the industry
3. Describe the business processes, including responsibilities of different cadres of personnel, for the engineering activities he/she is involved in a plant
4. Describe the general management of resources-tools, equipment, consumables, inventory among others.

Course Description

This will be at the end of their third year of study and will involve relevant organizations and industries. The student will be attached to an organization and be a part of the work force. They will participate in all activities related to: Routine office work, field work, workshop work, and any other work as may be assigned by the field supervisor. The student will be required to complete 12 weeks of the attachment. The student will be required to maintain a log-book which will be issued by the centre for Career Development. This will be the basis of the assessment when the students reports back at the university.

Assessment

Assessment will be based on a student's logbooks and reports by the University and industry supervisors.

Reference

University industrial partnership companies

3.4 Fourth Year of Study

3.4.1 First Semester

ECU 400: Research Methodology

Prerequisites: UCU 100: Communication Skills and ECU 302: Innovation and Entrepreneurship for Engineers

Objective

The objective of the course is to impart skills for preparation for research and for formulating proposals and appropriate competencies in reporting and presenting technical and scientific work.

Expected Learning Outcomes

At the end of this course a student is expected to be able to:

1. Carry out literature review and to write a scientifically sound proposal or technical

- report or paper
2. Prepare and to effectively employ, in oral presentations, modern presentation tools.
 3. Prepare a draft proposal for his/her final year project work.

Course Description

Sources of published materials in engineering. Techniques of literature searching. Methods of information retrieval. Project idea generation. Project proposal writing. Data collection and analysis. Preparation of scientific and technical reports. Presentation of reports. Dissemination of research findings. Case study and reports based on anticipated final year project areas.

Mode of Delivery

Lectures: 2 hour per week; tutorials and presentations: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 50%; Continuous Assessment 30%; Report examination: 20%.

Textbooks and References

- (a) Research Methodology: An Introduction for Science and Engineering Students, Stuart Melville and Wayne Goddard, Publisher: Juta and Co Ltd (1996) ISBN-10: 0702135623
- (b) Techniques for Student Research: A Comprehensive Guide to Using the Library, Nancy D. Lane, Margaret Chisolm, Carolyn Mateer, and Margaret E. Chisholm, Publisher: Neal-Schuman Publishers (2000) ISBN-10: 1555703674.
- (c) Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory, Juliet Corbin, Anselm C. Strauss, Publisher: Sage Publications, Inc; 3rd edition (2007), ISBN-10: 1412906431

ECU 401: Project Management

Prerequisites:

Objective

The objective of the course is to introduce the basic principles of project management.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. State the principles of management practice of Engineering Industry in Kenya
2. Describe types and procedures of contracting
3. Prepare contract documents
4. Do cost analysis and control in a project.

Course Description

Feasibility studies. Project planning. Project scheduling: Gantt Charts; Project Evaluation and

Review Techniques (PERT): Critical Path Method (CPM), Critical Path Analysis (CPA). Financial and economic appraisal of projects; discounted cash flow. Project control, monitoring and evaluation. Elements of operation research: Decision theory, decision trees and linear programming. Case study. Project Reporting.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% where: 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

- (a) Project Management: A Systems Approach to Planning, Scheduling, and Controlling by Harold Kerzner; Wiley; 9 edition (2005), ISBN: 0471741876
- (b) Absolute Beginner's Guide to Project Management, Greg Horine, Publisher: Que (2005) ISBN: 0789731975
- (c) Fundamentals of Project Management, James P. Lewis, Publisher: AMACOM; 3rd edition (2006); ISBN: 0814408796

ECV 400: Traffic Engineering I

Prerequisites: ECV 306: Transportation Planning & Development

Objective

The objective of the course is to introduce the basic principles of traffic engineering that governs traffic flow characteristics.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Evaluate traffic flow characteristics
2. Determine traffic flow volumes
3. Apply basic traffic flow models
4. Describe system operating environments

Course Description

Introduction, definitions. Traffic Engineering Elements; vehicle characteristics, human factors, road characteristics, control mechanism and terminal facilities. Traffic Flow fundamentals; traffic patterns, flow/speed/density relationship, stream characteristics. Traffic flow Data collection, Macroscopic and Microscopic Traffic flow Models, Shock waves, Queuing. Operational planning and management of the highway transportation, capacity and level of service analysis of highways, use of the highway capacity manual in design. System operating environments; policy and institutional issues, selection of strategies and tactics, evaluation.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct practical exercises involving

1. Determination of traffic volume on a section of a road
2. Acquisition and analysis of accident data.

Textbooks and References

1. Textbook:

(a) Rogers P. Roess; Traffic Engineering. Prentice Hall, 3rd ed. 2004. ISBN:0130812935

2. References

(a) Nicholas J. Garber & Lester A. Hoel; Traffic and Highway engineering. Cengage-Engineering, 2001

3. Journals and on-line materials (provided by KU Library)

- c) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- d) Ebrary, Springerlink, Data World Bank

ECV 401: Highway Engineering I

Prerequisites: ECV 308: Soil Mechanics II

Objective

The objective of the course is to impart knowledge on highway design.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Differentiate rural and urban roads and design traffic capacity
2. Design pavement structures
3. Differentiate horizontal and vertical alignment and their coordination
4. Identify different road furniture
5. Use computer packages for design of highways

Course Description

Design speeds for rural and urban roads. Traffic flow and design capacity: basic considerations, rural and urban highway design flows. Pavement structures, wearing courses and other components, pavement deflections measurements. Geometric design; horizontal : Curvature

and centrifugal force, sight distances at horizontal curves, widening of circular curves, and applications of transition curve and super elevation and vertical curves: gradients, design of climbing lanes, and sight distances at vertical curves. Co-ordination of horizontal and vertical alignments and elements of geometric designs. Intersection design: superhighway interchanges (with examples from Thika superhighway) at-grade junctions; roundabouts, conflicts points, kerbed and ghost islands, lane separation, acceleration and deceleration lanes, intersection sight triangles speed, sight distance and capacity. Cross-section elements: traffic lanes, central reservations, shoulders, laybys, bus bays and bus stops, camber, and side slopes. Road furniture: traffic islands, kerbs, safety fences, traffic signs and road markings. Use of computer highway design packages.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Execution of assignments by applying student edition computer programme for highway geometric design.

Textbooks and References

1. Textbook:

- (a) Paul H. Wright and Karen Dixon; Highway Engineering. Wiley, 7th ed., 2003. ISBN:047126461X

2. References

- (a) Traffic and Highway Engineering, Nicholas J. Garber and Lester A. Hoel, Cengage-Engineering; 4 edition (2008) ISBN-10: 0495082503

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 402: Irrigation Engineering I

Prerequisites: ECV 302: Hydraulics I

Objective

The objective of the course is to equip the student with basic knowledge on irrigation systems.

Expected Learning Outcomes:

At the end of the course, student should be able to

1. Evaluate irrigation requirement
2. Determine water requirement for crops
3. Describe management allowable deficit
4. Identify sources of irrigation water

Course Description

Evaluation of irrigation requirements and determination of soil suitability for crops; pH value, physical and chemical composition of soil solids. Water requirements of crops: evapotranspiration, soil and water potential, irrigation water quality. Irrigation water requirement: critical points, Management Allowable Deficit (MAD), optimum yield-MAD relationship analysis. Sources of irrigation water: surface and ground water sources.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Textbooks and References

1. Textbook:

(a) V.B. Priyani; Irrigation Engineering. Charotar Publisher, 5th ed., 2007.

2. References

(a) A. Benami and A. Ofen; Irrigation Engineering: Sprinkler, trickle, surface irrigation principles, design and agricultural practices. International irrigation information center, Ottawa, 1984. ISBN:965-222-0302

(b) R.K. Sharma and T.K. Sharma; Textbook of Irrigation Engineering. ISBN:8120405080.

3. Journals and on-line materials (provided by KU Library)

a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications

b) Ebrary, Springerlink, Data World Bank

ECV 403: Foundation Engineering I

Prerequisites: ECV 308: Soil Mechanics II

Objective

The objective of the course is to equip students with knowledge on foundations analysis and

design.

Expected Learning Outcomes

At the end of the course, student should be able to;

1. Apply Rankine's theory
2. Apply Coulomb's theory
3. Use Terzaghi's analysis
4. Calculate bearing capacities for deep foundations
5. Describe shoring and underpinning

Course Description

Earth pressures: lateral earth pressure, Rankine's theory (active and passive pressures), Coulomb's theory (active and passive pressures). Bearing capacity of shallow foundations: Limit analysis (upper and lower bound solutions), Rankine solution, Terzaghi's analysis, Meyerhof equation, eccentrically load foundation, Field correction. Settlement of shallow foundations: Elastic settlement, consolidation process and settlement, short and long term settlement. Bearing capacity of deep foundations: Piles, end bearing (Meyerhof, Versic, Janbu methods, SPT), Frictional resistance (sand, clay, $\alpha(\alpha)$, $\lambda(\lambda)$, $\beta(\beta)$ methods). Pile Settlement: Elastic solution, field loading test, pile group (efficiency, settlement), Negative skin friction, laterally loaded pile. Shoring and underpinning. Ground water: dewatering techniques. All related Laboratory and field tests.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four of the experiments listed below.

1. Settlement consolidation
2. Plate loading test
3. Los Angels Abrasion Value

Textbook

1. Braja M. Das; Principles of Foundation Engineering. Cengage-Engineering, 5th ed., 2003. ISBN:0534407528
3. Journals and on-line materials (provided by KU Library)
 - a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
 - b) Ebrary, Springerlink, Data World Bank

ECV 404: Structural Design I [Studio]

Prerequisites: ECV 208: Strength of Materials II, ECV 209: Theory of structures II, ECV 210: Civil Engineering Materials II

Objective

The objective of the course is to impart knowledge on the principles of structural steel design concepts.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Design and detail structural steel members and systems based on relevant code of practice
2. Fabricate steel structures.
3. Identify defects in steel structures
4. Design for wind and earthquake loads

Course Description

Steel design using current national design codes: Design strengths, section properties and member capacities. Limit state design of structural steelwork, structural systems in steel, beams, columns and tension members. Fire safety. Corrosion control. Detailing of structural steel elements. Principles of plastic analysis and design. Design of bolted and welded connections. Detailing guidelines. Steel structure design project. Fabrications and erection of steel trusses and portal frames for low rise buildings. Inspection, preventive maintenance and repairing of existing steel structures. The course shall be based on the following codes of practice: BS 5950, BS 6399, CP3 and Eurocode 3. Emphasis shall be laid on design and drawing exercises.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

40 % Continuous Assessment: 60 % Design project.

Practical work and Design Projects

Student will carry out structural design projects in groups. Each student is required to write his/her own report for marking.

Textbooks and References

1. Textbook:

- (a) Jack McCormac; Structural steel design. Prentice Hall, 4th ed. 2007. ISBN:013221816X
- (b) Charles G. Salmon, John Johnson & Faris Malhas; Steel Structures: Design and Behaviour. Prentice Hall, 5th ed. 2008. ISBN:0131885561.

2. References

- (a) William T. Segui; Steel Design. Cengage-Engineering, 4th ed., 2006.

ISBN:0495244716

3. Journals and on-line materials (provided by KU Library)
 - a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
 - b) Ebrary, Springerlink, Data World Bank

ECV 405: Theory of Structure V

Prerequisites: ECV 312: Theory of structures IV

Objective

The objective of the course is to impart knowledge on theory of structural dynamics.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Formulate equation for single degree of freedom
2. Determine the reaction of structures to forced vibration
3. Describe basic earthquake engineering

Course Description

Structural Dynamics: Formulation of equations for single degree of freedom, undamped and damped systems. Forced vibrations. Multi-degree of freedom dynamics. Introduction to Earthquake Engineering. Structural Instability.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week;

Assessment

Ordinary Examination at end of Semester 70%; Continuous Assessment 30% of which: 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Textbooks and References

1. Textbook:
 - (a) Theory of Structure Theory of Structures By KHURMI R.S ISBN 06-017129
2. References
 - (a) KHURMI R.S; Theory of Structure Vol. I ISBN 00-017129
 - (b) KHURMI R.S; Theory of Structure Vol. II.
3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

3.4.2 Second Semester

ECU 402: Engineering Economics

Prerequisites: ECU 302: Innovation and Entrepreneurship for Engineers and ECU 303: Industrial Practical Attachment I.

Objective

This course provides the student with an introduction to the monetary side of engineering. In broad terms, for an engineering design to be successful, it must be technically sound and produce benefits. These benefits must exceed the costs associated with the design in order for the design to enhance net value. The basic elements of modern engineering economics require the application of engineering design and analysis principles to provide goods and services that satisfy the consumer at an affordable cost. This course also provides coverage of the institutional background and the history of significant engineering economic ideas and issues in Kenya and around the world. It will develop an understanding of how engineering economics relates to practical life. Students are expected to apply the knowledge in other relevant courses. The general objective of the course is to impart knowledge on basics of economics in planning, design, manufacturing/implementation, construction/installation, commissioning, operation and maintenance in the engineering industry.

Expected Learning Outcomes

At the end of this course the student is expected to:

1. Acquire and independently apply concepts and techniques of economic analysis used to form engineering decisions.
2. Assess cost implication in engineering design and application.
3. Select a preferred course of action based upon monetary and non-monetary considerations
4. Assess risks and uncertainty associated with engineering economic decisions.

Course Description

Origins of Engineering Economics, principles of engineering economics, engineering economics and the design process, accounting and engineering economic studies, theory of demand, supply and the concept of equilibrium, concept of elasticities of demand, theory of production and costs, cost- driven design optimization, perfect/ atomistic/ pure competition, monopoly, monopolistic competition, oligopoly, investments, MEC and MEI, money- time relationships and equivalence, application of money time relationships, comparing alternatives, basic theories of international trade, balance of payment, current and capital accounts, price changes and the exchange rates, depreciation concepts and terminologies, classical (Historical) depreciation methods, modified accelerated cost recovery system, introduction to income taxes, effective (marginal) corporate income tax rate, gain (loss) on

the disposal of an asset, general procedure for making after tax economic analysis, an integrated approach to cost estimation, selected estimating techniques (models), parametric cost estimating, cost estimation in the design process, estimating cash flows for a typical small project, reasons for replacement analysis, factors that must be considered in replacement studies, determining the economic life of a new asset (challenger), determining the economic life of a defender, comparisons in Which the defender's useful life differs from that of the challenger, retirement without replacement (Abandonment), Risk, uncertainty and sensitivity, sources of uncertainty, sensitivity analysis, analyzing a proposed business venture, risk- adjusted minimum attractive rates of return, reduction of useful life, perspectives and terminologies for analyzing public projects, self- liquidating projects, multi-purpose projects, difficulties in evaluating public sector projects, what interest rate should be used for public projects, the benefit cost ratio method, evaluating independent projects,

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70%. Continuous Assessment: 30% where 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. Sullivan, W.G., Bontadelli, J.A., Wicks, E.M., 2001, Engineering economy, London, Prentice Hall.
2. Grant, E.L., Ireson, W.G., Leavenworth, R.S., 1990, Principles of Engineering economy, 8th ed, New York, John Wiley & Sons.
3. N. M. Fraser, J. Bernhardt, and E. M. Jewkes, 2000. Engineering Economics in Canada,, 2nd Edition. Prentice Hall, Toronto
4. Shapiro, E., 1993, Macroeconomic Analysis, New York, Harcourt Brace Jovanovich Inc.
5. Mankiw, N. G., 2004, Principles of Macroeconomics, Cincinnati, South- Western Publishing.
6. Dornbusch, R., Fischer, S., 1990, Macroeconomics, McGraw- Hill.
7. Nicholson, W., 1992, Microeconomic Theory: Basic principles and extensions, 5th ed, San Diego, Dryden Press
8. Koutsoyiannis, A., 1979, Modern Microeconomics, 2nd ed, Macmillan
9. Mansfield, E., Microeconomic theory and applications, New York, Norton.
10. Principles of Marketing, Philip Kotler and Gary Armstrong, Prentice Hall; 12 edition (2007), ISBN: 0132390027
11. Evans J. R., Berman B., "Marketing" Maxwell MacMillan (1990)
12. Payne C. A., Chelson, J. V., Reavill, L. R., "Management for Engineers" Wiley (1996)

ECV 406: Transportation Engineering

Prerequisites: ECV 306: Transportation planning and development

Objective

The objective of the course is to enable the student understand the basics of transportation engineering.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Use traffic engineering models and analysis techniques transportation system
2. Forecast the demands for transportation.
3. Design and evaluate transportation networks

Course Description

Introduction to transportation engineering; models and traffic data gathering and analysis techniques, sample size considerations.

Experiment design for demand forecasting and operations analysis.

Use of transportation demand models in urban and rural applications. Design and evaluation of multi modal transportation networks.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% of which 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Practical work will involve carrying out a field study following guidelines prepared by the course lecturer.

Textbook

C.S. Papacostas and P.D. Prevedouros: Transportation Engineering and planning. Prentice -Hall, 2nd ed., 1992. ISBN:0139580751

3. Journals and on-line materials (provided by KU Library)
 - a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
 - b) Ebrary, Springerlink, Data World Bank

ECV 407: Hydrology II

Prerequisites: ECV 307: Hydrology I and ECU 201: Engineering Mathematics VI

Objective

The objective of the course is to equip a student with skills to transform rainfall data into flow and forecast future values based on probability methods and river stage measurement into discharge.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Build and analyze a hydrograph from rainfall data
2. Use probability methods to estimate values
3. Carry out measurement of stream flow and conversion of stage measurements into discharge.
4. Determine design flows

Course Description

Stream flow hydrographs and their characteristics; derivation of unit hydrograph and its applications, hydrograph of overland flow, ratios between precipitation and runoff. Hydrologic and hydraulic routings. Probability in hydrology: risk Analysis, return period, flood damage and control. Stream flow data analysis, synthetic hydrograph. Design flows: storm sewer design, design floods, Spillways design flows.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% of which 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four experiments covering:

1. Stream gauging and measurement
2. Flow velocity measurement in hydraulic channels.

Textbooks and References

1. Textbook:

(a) John C. Manning; Applied principles of hydrology. 3rd ed., 1996, Prentice Hall Earth Sciences, ISBN:0135655323

2. References

(a) Kenneth N. Brooks, Peter F. Ffolliott, Han M. Gregersen and Leonard F. DeBano; Hydrology and the management of watersheds. 3rd ed. Jan 13 2003, Wiley

BlackWell, ISBN:0813829852 ISBN-10.

3. Journals and on-line materials (provided by KU Library)
 - a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
 - b) Ebrary, Springerlink, Data World Bank

ECV 408: Traffic Engineering II

Prerequisites: ECV 400: Traffic Engineering I and ECU 201: Engineering Mathematics VI

Objective

The objective of the course is to impart students with basic knowledge of traffic flow characteristic

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Be able to apply stochastic models
2. Be able to design traffic facilities
3. Determine traffic flow volumes
4. Be able to design traffic interchanges

Course Description

Introduction of stochastic models, Poisson arrivals and diffusion approximations. Planning, implementation, and operations of control technologies. Design of traffic facilities; Freeways, Intersections; signalized & un-signalized, Interchanges and parking facilities. Stationary flows, flow conservation, traffic assignment, hierarchy structure of highway networks, time-dependent flows in bottlenecks. Graphs, theory, shortage paths, continuum approximations, vehicle routing.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester: 70%. Continuous Assessment: 30% of which 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct practical exercises involving

1. Determination of traffic volume on a section of a road

Textbooks and References

1. Textbook:

(a) Rogers P. Roess; Traffic Engineering. Prentice Hall, 3rd ed. 2004. ISBN:0130812935

2. References

(a) Nicholas J. Garber & Lester A. Hoel; Traffic and Highway engineering. Cengage-Engineering,2001

3. Journals and on-line materials (provided by KU Library)

a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications

b) Ebrary, Springerlink, Data World Bank

ECV 409: Highway Engineering II

Prerequisites: ECV 401: Highway Engineering I and ECV 403: Foundations Engineering I

Objective

The objective of the course is to impart knowledge on highway construction materials, design and construction methods

Expected Learning Outcomes

At the end of the course, student should be able to

1. Determine stresses in flexible and rigid pavements
2. Select suitable highway construction materials
3. Design highways using different methods
4. Use different construction methods to achieve desired capacity.

Course Description

Pavement types: flexible and rigid. Stresses in flexible pavements and wheel load characteristics. Construction materials: bituminous, origins, structures and classification and properties. Polymers: structure, thermoplastics and thermosets, plasticers co-polymers, properties and temperature effects. Cement bound granular materials, design of concrete. Highways road note 2, reinforced, unreinforced, joint details. Design methods: empirical and analytical methods, Road Note (RN) 29, and RN 31, standards from the public sector. Construction techniques; cut and fill, surfacing, drainage systems. Base construction: stabilization using cement, lime, and bitumen, labour intensive techniques, stage construction, Introduction to road maintenance and construction plants. Design and construction of superhighways such as Thika superhighway, challenges and new concepts of design.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% of which 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at the experiments listed below.

1. Determination of construction material CBR value
2. Determination of the ductility of the material
3. Determination of the Marshall index

Textbooks and References

1. Textbook:

- (a) Paul H. Wright and Karen Dixon; Highway Engineering. Wiley, 7th ed., 2003. ISBN:047126461X

2. References

- (a) Traffic and Highway Engineering, Nicholas J. Garber and Lester A. Hoel, Cengage-Engineering; 4 edition (2008) ISBN-10: 0495082503

ECV 410: Irrigation Engineering II

Prerequisites: ECV 402: Irrigation Engineering I

Objective

The objective of the course is to equip a student with knowledge on irrigation, drainage and design of irrigation infrastructure.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Determine the drainage requirements of irrigation systems
2. Design and specify components and accessories of irrigation systems,
3. Design suitable drip irrigation systems.
4. Select pump and understand their operation and maintenance

Course Description

Theory and design of: gravity, sprinkler and trickler irrigation systems. Drainage: Theory, design, construction, operation and maintenance. Drip irrigation systems: hydraulics, water regime and design. Accessories design. Accessories: filters, fertilizer injectors, vacuum breakers, flushing valves, cases studies. Relation between irrigation regime and choice of irrigation methods. Efficient use of water and integrated projects. Pumps: types, selection, operation and maintenance.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% where 20% shall be continuous assessment tests and 10% shall be assignments.

Practical work/Laboratory Exercises

Design of a drip irrigation system

Textbook; and References

1. Textbook:

(a) V.B. Priyani; Irrigation Engineering. Charotar Publisher, 5th ed.,2007.

2. References

(a) A. Benami and A. Ofen; Irrigation Engineering: Sprinkler, trickle, surface irrigation principles, design and agricultural practices. International irrigation information center, Ottawa, 1984. ISBN:965-222-030-2

(b) R.K. Sharma and T.K. Sharma; Textbook of Irrigation Engineering. ISBN:8120405080.

3. Journals and on-line materials (provided by KU Library)

a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications

b) Ebrary, Springerlink, Data World Bank

ECV 411: Foundation Engineering II

Prerequisites: ECV 403: Foundation Engineering I and ECV 308: Soil Mechanics II

Objective

The objective of the course is to equip students with knowledge on foundations design

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Design different types of foundations
2. Design and know failure modes of retaining wall
3. Check stability foundation and retaining walls

Course Description

Design of Foundations: pad footing, strip, rafts, piles, piers and caissons. Retaining walls (gravity, cantilever): analysis and reinforcement design, failure modes, abutments. Sheet pile walls: Cantilevered and anchored. Cofferdams (Types, uses), Stability and Design. Braced Excavations.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester: 70%. Continuous Assessment: 30% of which 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

1. Plate load test

Textbook

- (a) Braja M. Das; Principles of Foundation Engineering. Cengage-Engineering, 5th ed., 2003. ISBN:0534407528

Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 412: Structural Design II [Studio]

Prerequisites: ECV 404: Structural Design I

Objective

The objective of the course is to equip the student with knowledge on the design of reinforced concrete design.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Design reinforced concrete members
2. Provide Bar detailing and specifications
3. Design for earthquake and wind loads

Course Description

Philosophy of design including: conceptual and detailed design, elastic design, Limit state design, ultimate limit states, serviceability limit states. Design process including: architectural drawings, types of loading, design loads, beam and column design, introduction to design of storied residential buildings. Reinforced concrete (RC) design using current national design codes: material properties, stress-strain curves, design of reinforced concrete beams, columns, slabs, footings and staircases, detailing guidelines. Presentation and working drawings. Introduction to analysis and design of Prestressed concrete. Introduction to the use of computers in design and drafting. Relevant design projects.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory

work.

Assessment

40% Continuous Assessment: 60% Design project.

Practical work and Design Projects

Student will carry out structural design projects in groups. Each student is required to write his/her own report for marking. Part of the practical work shall include conducting the experiments indicated below.

Practical work/Laboratory Exercises

1. Reinforcement bar tensile test
2. Reinforced concrete beam testing in flexure.

Textbooks and References

1. Textbook:

(a) Jack McCormac; Design of reinforced concrete. Wiley 7th ed., 2005. ISBN:047176132X

2. References

(a) Chu-Kia Wang and Charles G. Salmon; Reinforced Concrete Design. Wiley 6th ed., 1998. ISBN:0471364223

ECU 403: Industrial Practical Attachment II (12 weeks)

Prerequisites: ECU 303: Industrial Practical Attachment I

Objective

The objective of the course is to provide a student with exposure to actual engineering practices and processes in the industry whose operations are relevant to the programme of study.

Expected Learning Outcomes

At the end of the course a student will be expected to be able to

1. Describe, design and operate equipment exposed to in a water or civil engineering plant
2. Describe the maintenance of equipment exposed to in the industry
3. Describe the business processes, including responsibilities of different cadres of personnel, for the engineering activities he/she is involved in a plant
4. Describe the general management of resources-tools, equipment, consumables, inventory among others.

Course Description

This will be at the end of their fourth year of study and will involve relevant organizations and industries. The student will be attached to an organization and be a part of the work force. They will participate in all activities related to: Routine office work, field work, workshop work, and any other work as may be assigned by the field supervisor. The student will be required to complete 12 weeks of the attachment. The student will be

required to maintain a log-book which will be issued by the Centre for Career Development. This will be the basis of the assessment when the students reports back at the university.

Assessment

Assessment will be based on a student's logbooks and reports by the University and industry supervisors.

Reference

University industrial partnership companies

3.5 Fifth Year of Study

3.5.1 First Semester

Core Units

ECU 500: Engineering Practice and Ethics

Pre requisite: ECU 400: Research Methodology, ECU 401: Project Management and ECU 403: Industrial Attachment II

Expected Learning Outcome

Students will be able to appreciate the need for ethics in their dealings with their clients and the society at large.

Course Description

Engineering Ethics: Fundamental principles of engineering practice. Rules of practice. Professional obligations. Engineering Consultancy. The nature and sources of contract. The law of tort. Intellectual property laws. Contractual obligations. The Engineers Act. Engineers Professional Societies. The engineer as a consultant. The engineer as a contractor. Engineer in contractual disputes. The role of an engineer in society. The Occupational Safety and Health Act and conditions of work. ISO 9000. ISO 14001. ISO 18000. Industrial relations in Kenya. Trade unions, Collective bargaining, labour laws, arbitration and the industrial court. Kenya Business Units: sole proprietorship, partnership, limited liability company, corporation, parastatal and cooperatives.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% where 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. The Engineers Act, 2011

2. Code of Ethics for Engineers by the ERB
3. Professional Engineer's Training Standards

ECV 500: Civil Engineering Project I

Prerequisites: ECU 400: Research Methodology and All Units

Objective

The objective of the course is to impart skills for undertaking realistic engineering research and/or design projects.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Clearly define a research and/or engineering problem
2. Work out realistic methods for solution of a research problem
3. Make realistic plans of time and resources for implementation solution of the engineering problem
4. Effectively apply the theoretical knowledge gained in the course to the problem
5. Follow standard scientific and engineering practices in presentation of drawings and report
6. Communicate effectively in writing of the reports and in presenting his/her findings.

Course Description

Each final year student will undertake a project over two semesters which is approved by the department and carried out under the supervision of academic staff. Final year students will carry out project work from any discipline in Civil Engineering. The project should belong to one or more of the following areas: computing and analysis; design; laboratory investigation; field testing and instrumentation; case studies. The project duration is over the entire academic year or calendar year. A formal report will be required. Each student is required to make an oral presentation.

Mode of Delivery

Lecture: 1 hours per week; Tutorials: 2 hours per week; Laboratory/Practical/Project: 6 hours per week.

Assessment

Assessment is 100% by course work. The distribution of marks will be based on assessment formats provided by the department.

ECV 501: Structural Design III (Studio)

Prerequisites: ECV 412: Structural Design II

Objective

The objective of the course is to equip the student with knowledge on the timber and masonry design.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Apply the knowledge of structural design of timber and masonry
2. Design for the earthquake and wind loads

Course Description

Timber design using current national design codes; Analysis and design of tension members, beams and columns (solid and spaced). Design of nailed and bolted connections. Design of timber decking and glue laminated members. Detailing of timber structures and connections. Timber structure design project. Masonry design including: limit state design of unreinforced masonry walls, strength of materials, partial safety factors, capacity reduction factor. Introduction to the use of computers in design and drafting. Relevant design projects.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

40% Continuous Assessment: 60% design project.

Practical work and Design Projects

Student will carry out structural design projects in groups. Each student is required to write his/her own report for marking. Part of the practical work shall include conducting the experiments indicated below.

Textbooks and References

1. Textbook:

- (a) Abdy Kermani; Structural Timber Design. Blackwell Science LTD, 1999. ISBN 0-632-05091-8
- (b) Jack McCormac; Design of reinforced concrete. Wiley 7th ed., 2005. ISBN:047176132X

2. References

- (a) W. M. C. McKenzie; Design of Structural Timber. Macmillan Press LTD 2000 ISBN 0-333-79236-x
- (b) Chu-Kia Wang and Charles G. Salmon; Reinforced Concrete Design. Wiley 6th ed., 1998. ISBN:0471364223

ECV 502: Water Resources Engineering I

Prerequisites: ECV 309: Hydraulics II

Objective

The objective of the course is to impart knowledge on different types of water resources and how to harness the same.

Expected Learning Outcomes

At the end of the course, student should be able to;

1. Demonstrate basic water resources engineering
2. Describe different types of water resources
3. Describe hydro-electric power production dams

Course Description

Introduction to water resources engineering; global overview. Ground water resources. Reservoirs; planning and investigation, erosion and sedimentation. Sediment transport. Hydroelectric power production Dams: **earth dams** spillways and outlet works.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% of which 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for practical work.

Textbooks and References

1. Textbook:

- (a) Rey K. Linsley, Joseph B. Frenzi & George Tchobanoglous; Water Resources Engineering. McGraw-Hill, 4th ed., 1992. ISBN:0-07-112689-9

2. References

- (a) Ralph A. Wurbs and Wesley P. James; Water Resources Engineering. Prentice Hall, 2001. ISBN:0130812935

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 503: Highway Materials

Prerequisites: ECV 403: Foundations Engineering I and ECV 409: Highway Engineering II

Objective

The objective of the course is to impart knowledge on highway construction materials, design and construction methods.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Select various Highway materials
2. Appreciate types, properties of bitumen and tests for bitumen
3. Describe physical, mechanical and chemical properties of aggregates.
4. Describe types of premix as a construction material.
5. Demonstrate quality control of highway materials.

Course Description

Highway materials: natural soils and gravels, crushed rock, stabilized soils and gravels, bituminous materials, organic cements. Bitumen: Manufacture, types and properties of bitumen; straight-runs, cut-backs, emulsions. Tar; Manufacture of Tars. Tests for bitumen and tars such as standard penetration and viscosity tests. Aggregates: Physical, mechanical and chemical properties of aggregates. Bituminous mixes: Types of premix, design of premixes using methods such as Marshall method. Recycling of bituminous materials. Lime; composition and manufacture of limes. Lime, cement and bitumen as stabilizing agents of highway construction materials. Quality control of highway materials.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% of which 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at the experiments listed below.

1. Determination of construction material CBR value
2. Determination of the ductility of the material
3. Determination of the Marshall index

Textbooks and References

1. Textbook:

(a) Paul H. Wright and Karen Dixon; Highway Engineering. Wiley, 7th ed., 2003. ISBN:047126461X

2. References

(a) Traffic and Highway Engineering, Nicholas J. Garber and Lester A. Hoel, Cengage-Engineering; 4 edition (2008) ISBN-10: 0495082503

ECV 504: Construction Management

Prerequisites: ECU 401: Project Management, ECU 402: Engineering Economics,

Objective

The objective of the course is to impart knowledge on procedures and construction documents.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

5. Describe the principles of management practice of construction industry in Kenya
6. Describe types and procedures of contracting
7. Prepare contract documents
8. Do cost analysis and control in construction site.

Course Description

Principles of management practice, management functions, structure of construction industry in Kenya, Civil and Structural engineering contracts: types and procedures of contracts, contract documents, conditions of contract, instructions to tenderers. Preparation of specifications and bills of quantities. Working contract drawings. Tendering procedures, bidding strategy, measurements. Accounting methods and cost control: Book keeping, financial statements. Cost benefit analysis, discounted cash flow.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70 % Continuous Assessment: 30 % where 20 % shall be continuous assessment tests and 10 % shall be assignments.

Textbooks and References

- (a) Project Management: A Systems Approach to Planning, Scheduling, and Controlling by Harold Kerzner; Wiley; 9 edition (2005), ISBN: 0471741876
- (b) Absolute Beginner's Guide to Project Management, Greg Horine, Publisher: Que (2005) ISBN: 0789731975
- (c) Fundamentals of Project Management, James P. Lewis, Publisher: AMACOM; 3rd edition (2006); ISBN: 0814408796

ECV 505: Environmental Engineering

Objective

The objective of the course is to equip the student with knowledge on various aspects of environmental stress, conservation and sustainable development.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Explain problems of environmental change and how to assess them
2. Explain mechanisms of global warming and effects as well as mitigation
3. State sources of global data on environmental pollution and explain the role of UNEP.

Course Description

General problems of the global environmental change. Environmental assessment and sustainable development. Science and policy of global environmental conservation. Classification and characteristics of natural disaster. Flood drought protection. Mechanism of global warming, air pollution, forest decline, acid rain, freshwater pollution, marine pollution and their countermeasures. Case studies: current global environmental situation from United Nations Environmental Programme (UNEP) and environment secretariat in Kenya.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% where 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. Textbooks:

- a) Joseph A. Salvato, Nelson L. Nemerow and Franklin J. Agardy; Environmental Engineering. Wiley, 5th ed. 2003. ISBN:047141837

2. References:

- a) Mackenzie Davis and Susan J. Masten; Principles of Environmental Engineering and Science. McGraw-Hill, 2003. ISBN:0072350539

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 506: Public Health Engineering III

Prerequisites: ECV 310: Public Health Engineering II

Objective

The objective of the course is to impart knowledge design of water and waste water conveyance and treatment units

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Describe waste water treatment and disposal methods for large communities
2. Describe sludge treatment and disposal methods
3. Describe waste water reclamation and re-use
4. Describe langmuir, Freundlich and BET Adsorption Isotherms
5. Apply of Granular Activated Carbon (GAC) in water treatment
6. List and describe methods of solid waste collection and disposal

Course Description

Waste water treatment and disposal; methods for large communities treatment; Characteristics and design criteria for preliminary, primary, secondary, oxidation ponds, trickling filters, activated sludge and . Sludge treatment and disposal; characteristics, treatment methods, disposal methods. Waste water reclamation and re-use; re-use potential, applications, quality considerations. Adsorption: definition, nature of adsorbent and adsorbate, adsorption equilibria, equilibrium batch adsorption. Langmuir, Freundlich and BET Adsorption Isotherms. Application of Granular Activated Carbon (GAC) in water treatment. Solid waste collection and disposal; classification, properties, generation, collection systems, ultimate disposal.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester: 70 %. Continuous Assessment: 30 % of which 10 % shall be continuous assessment tests and 5 % shall be assignments and 15 % shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct the four experiments listed below.

1. Wastewater treatment using GAC
2. Field work

Textbooks and References

1. Textbook:

- (a) George Tchobanoglous, Franklin L. Burton and H. David Stensel; Wastewater Engineering: Treatment and Reuse. Mcgraw-Hill, 4th ed., 2002.

(b) Metcalf & Eddy, "Wastewater Engineering (Treatment and Reuse)", 4th edition, Tata McGraw-Hill

2. References

(a) Wastewater Engineering. McGraw-Hill, 4th ed., 2002. ISBN:0077124140X

(b) Practical handbook on public health engineering. G. S. Bajwa

3.5.2 Second Semester

Core Units

ECV 523: Civil Engineering Project II

Prerequisites: ECU 400: Research Methodology and All Units

Objective

The objective of the course is to impart skills for undertaking realistic engineering research and/or design projects.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Clearly define a research and/or engineering problem
2. Work out realistic methods for solution of a research problem
3. Make realistic plans of time and resources for implementation solution of the engineering problem
4. Effectively apply the theoretical knowledge gained in the course to the problem
5. Follow standard scientific and engineering practices in presentation of drawings and report
6. Communicate effectively in writing of the reports and in presenting his/her findings.

Course Description

Each final year student will undertake a project over two semesters which is approved by the department and carried out under the supervision of academic staff. Final year students will carry out project work from any discipline in Civil Engineering. The project should belong to one or more of the following areas: computing and analysis; design; laboratory investigation; field testing and instrumentation; case studies. The project duration is over the entire academic year or calendar year. A formal report will be required. Each student is required to make an oral presentation.

Mode of Delivery

Lecture: 1 hours per week; Tutorials: 2 hours per week; Laboratory/Practical/Project: 6 hours per week.

Assessment

Assessment is 100% by course work. The distribution of marks will be based on assessment formats provided by the department.

ECV 507: Geotechnical Engineering

Prerequisites: ECV 411: Foundation Engineering II and ECU 301: Engineering Mathematics X

Objective

The objective of the course is to impart knowledge on on design and construction of tunnels and dams.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Describe rock mechanics
2. Carry out bearing capacity tests
3. Carry out geotechnical site investigation
4. Apply numerical modeling in geomechanics

Course Description

Design and construction of Tunnels, shafts and dams. Rock mechanics: classification according to strength, stress analysis, mechanical testing. Determination of rock mass properties and rock support interaction. Use of Rock quality indices. Design of rock bolts support systems. In-situ bearing capacity tests:- plate bearing, Dynamic Cone Penetration and Pile Load tests. Geotechnical site investigations: boring and sampling, penetration tests, remote sensing, geophysical exploration. Numerical modelling in Geomechanics. Introduction to related computer software.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70%. Continuous Assessment: 30% of which 10 % shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Text books and Reference Books

Text Books

1. Fundamentals of Geotechnical Engineering by Braja M. Das. 7th Edt, Nov 2007. ISBN 0495295728.
2. An Introduction to Geotechnical Engineering by Robert D. Holtz, William D. Kovas, Thomas C. Sheahan. 2nd Edt, Oct 2010. ISBN 0132496348.

References

1. Text book of Geotechnical Engineering by Iqbal H. Khan. Prentice Hall of India. 2nd Edition 2005.

2. Geotechnical Engineering Principles and Practice by Donald P. Koduto, Man-chu, Ronald Young, William A Kitch. 2nd Edition.

ECV 522: Design and Construction of Dams

Prerequisites: ECV 300: Engineering Geology, ECV 302: Hydraulics I, ECV 309: Hydraulics II, ECV 308: Soil Mechanics II

Objective

The objective of the course is to impart knowledge essential in detailed design and construction of dams.

Expected Learning Outcomes

At the end of the course a student should be able to;

1. Select dam location
2. Carry out geological and geotechnical investigation in the field.
3. Carry out design of various types of dams
4. Assess the performance of dams
5. Carry out embankment stability analysis using different methods under different operating conditions.
6. Compute stability analysis for concrete mass dam and determine the stresses developed in critical points
7. Monitor the safety and performance of dams

Course Description

Project development: geology, morphology and topography, hydrology selection of dam location .Investigation of substrata and construction materials: general investigation, field investigation-geological and geotechnical investigation, boreholes penetration tests, test pits, adits, laboratory investigations, cohesive and non-cohesive soils. Types of dams: concrete, earth and rock fill dams, masonry dams. Assessment of the performance of dams: static loads- deformation due to dead load, deformation due to impounding, slope stability, sliding stability, dynamic loads, hydraulic loads, seepage through dam, seepage through foundation. Stability analysis: static load- limit equilibrium, stresses and deformation, hydraulic conditions, dynamic loads- limit equilibrium, stresses and deformation. Monitoring of the safety and performance of dams: dam instrumentation, types and installation.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester: 40% Continuous Assessment: 60% course.

Practical work and Design Projects

Student will carry out structural design projects of dams and embankments. Each student is required to write his/her own report for marking.

Textbooks and References

1. Textbook:

- a) Albertson; Design hydraulic structures 89. Taylor and Francis, 1989. ISBN: 9061918987

2. References

- a) Larry W. Mays; Hydraulic design handbook. McGraw-Hill, 1999. ISBN: 0070411522

ECV 509: Civil Engineering Practice

Prerequisites: ECU 401: Project Management and ECV 504: Construction Management

Objective

The objective of the course is to impart basic knowledge on Civil engineering professional ethics.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Describe the law of contract
2. Explain professional and ethical responsibility of professional engineers
3. Describe different engineering professional societies
4. Differentiate the role of engineer as a consultant and as a contractor

Course Description

The nature and sources of law of contract and the law of tort, patent laws. Engineering ethics: fundamental principles of the engineering practice, rules of practice, professional obligations, contractual obligations according to FIDIC Green Book. Understanding Engineers' Registration Act. Engineering mentorship. Engineering professional societies. Roles of an Engineer in a contract: Engineer as consultant. Engineer as an adjudicator, Engineer as a certifier, Engineer as a designer, Engineer as contractor

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% of which 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

References

1. ICE and FIDIC Conditions of contract
2. Civil Engineering Procedure (ICE)
3. Civil Engineering Contract Administration by Atkinson

ECV 510: Logistics and System Analysis in Transportation

Prerequisites: ECV 406: Transportation Engineering I and ECV 306: Transportation planning and development.

Objective

The objective of the course is to impart knowledge on characteristic of different types of transportation technology.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Identify different types of transportation technologies
2. Identify the emerging transportation technologies
3. Carry out transportation inventories
4. Describe carrier network and logistic operation of transportation

Course Description

Economic characteristics of selected transportation technologies; road transport, rail transport, air transport, sea transport and pipelines. Transportation and sustainability, Emerging transportation Technologies. Transportation Economics. Optimization, evaluation, costing and modeling. Transportation inventory. Production cost interrelationships. Physical distribution and carrier networks. Logistics operations, system design.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester: 70 %. Continuous Assessment: 30 % of which 10 % shall be continuous assessment tests and 5 % shall be assignments and 15 % shall be for laboratory exercises.

Practical work/Laboratory Exercises

Practical work will involve carrying out a field study following guidelines prepared by the course lecturer.

Textbook

1. C.S. Papacostas and P.D. Prevedouros: Transportation Engineering and planning. Prentice -Hall, 2nd ed., 1992. ISBN:0139580751
2. Journals and on-line materials (provided by KU Library)
 - a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
 - b) Ebrary, Springerlink, Data World Bank

Electives

Select only THREE from the following:

Water Resources and Public Health Engineering (Option 1)

ECV 511: Public Health Engineering IV

Prerequisites: ECV 506: Public Health Engineering III

Objective

The objective of the course is to impart knowledge on design of water and waste water conveyance and treatment units

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Apply knowledge of fluid mechanics and environmental engineering to the problems of drinking water distribution, wastewater collection.
2. Provide meaningful experience in solving water and wastewater piping systems
3. Design drinking water distribution systems and wastewater collection systems
4. Design water supply and wastewater treatment units
5. Perform financial analysis of water supply and wastewater projects
6. Determine characteristics of air pollution

Course Description

Hydraulics: Design of water conveyance system. Design of a gravity and rising main. Design of sanitary structures, waste water conveyance and treatment units. Typical design of water supply and waste water treatment facilities. Financial and economic analysis of water supply and sewerage projects. Least Cost Analysis (LCA). Introduction to air pollution and control. Determination of organic constituents, mixing characteristic and determination of metals.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% of which 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct the four experiments listed below.

1. Design studio for water distribution, wastewater conveyance and water and water

- treatment units
2. Field work

Textbooks and References

1. Textbook:

- (a) George Tchobanoglous, Franklin L. Burton and H. David Stensel; Wastewater Engineering: Treatment and Reuse. McGraw-Hill, 4th ed., 2002.
- (b) Metcalf & Eddy, "Wastewater Engineering (Treatment and Reuse)", 4th edition, Tata McGraw-Hill

2. References

- (a) Wastewater Engineering. McGraw-Hill, 4th ed., 2002. ISBN:0077124140X
- (b) Practical handbook on public health engineering. G. S. Bajwa

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 512: Water Resources Engineering II

Prerequisites: ECV 502: Water Resources Engineering I

Objective

The objective of the course is to impart knowledge on water as a resource and its integrated development and management and to introduce laws governing public and private water abstraction, quality and quantity control

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Explain the importance of water as an international/regional resource
2. Explain the background and principles of IWRD and IWRM in relation to sustainable development
3. Use tools for water resources control and planning
4. Use of probability in design
5. Use water harvesting and conservation techniques
6. Identify legal and institutional framework for water resources management in Kenya.

Course Description

Integrated water resources planning. Water resources planning in arid and semi-arid areas and waste lands. Draught management. Water harvesting and conservation techniques. Engineering economy in water resources. Deterministic computer simulation/modelling. Water Law and National Water Policy.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% where 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. Textbook:

- a) David Stephenson; Water resources management. Taylor and Francis, 2003. ISBN:905895738.

3. Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 513: Groundwater Abstraction and Recharge

Prerequisites: ECV 300: Engineering Geology

Objective

The objective of the course is to impart knowledge on techniques of groundwater exploration, well development and testing.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. To explain groundwater flow to wells and boreholes
2. Explain the use of various techniques of groundwater exploration
3. Describe well construction, protection and testing for yield
4. Explain likely treatment processes for groundwater.

Course Description

Theory of groundwater flow to wells and boreholes: confined and unconfined aquifers, flow to galleries, single wells and well systems. Theory of groundwater flow from infiltration works: storage, variation in detention time, water quality variations, hydraulics of induced recharge. Abstraction: types of wells and boreholes. Design of wells and boreholes. Drilling and digging methods. Pertaining equipment. Wall casing. Filters construction. Protection of wells and boreholes. Cleaning of wells and boreholes. Pumping systems and pumps. Power supply. Recharge: design of surface water infiltration facilities such as ponds, ditches, gravel filled slits. Treatment of water that is to be infiltrated: treatment methods, membrane filter index. Types of infiltration wells and boreholes. Design of wells and boreholes. Drilling and digging methods. Pertaining equipment. Wall casing. Filters construction. Protection of wells and boreholes. Cleaning of wells and boreholes. Pumping systems and pumps including power supply. Effects of groundwater abstraction and recharge on the environment: effects

of the change of groundwater flows and levels on the quality of the subsoil, flora and fauna.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% where 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and Reference

Textbook:

- Practical Handbook of Environmental Site Characterization and Ground-Water Monitoring, by David M. Nielsen, CRC; Second Edition (2005) ISBN-10: 1566705894

Reference

- Handbook of Ground Water Development, Roscoe Moss Company, Wiley-Interscience; 1st edition (1990), ISBN-10: 0471856118
3. Journals and on-line materials (provided by KU Library)
- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
 - b) Ebrary, Springerlink, Data World Bank

Structural Engineering (Option 2)

ECV 514: Theory of Structures VI

Prerequisites: ECV 405: Theory of Structures V

Objective

The objective of the course is to equip the student with knowledge on various aspects structural analysis and design.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Explain the basic plastic and upper and lower limit theorems
2. Perform plastic analysis and design of various components of a structure
3. Discuss the theory of plates and shells

Course Description

Theory of plates and shells. Plastic analysis of beams, trusses and columns. Upper and lower limit theorems. Design of beams and frames using plastic method. Design of slabs using yield

line methods.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% where 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. Textbooks:

- a) Theory of structures – B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, New Delhi, 1999
- b) Indeterminate Structural Analysis – S.J. Kinney, Oxford IBH Publishing Co., 1999.
- c) Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, Theory of Structures, Laxmi Publications Pvt. Ltd., New Delhi, 2004.
- d) Vaidyanadhan R. and Perumal P., Structural Analysis – Vol. I and Vol. II, Laxmi Publications, New Delhi, 2007.

2. References

- a) Matrix analysis of framed structures – William Weaver, Jr & James M.Gere, CBS & Distributors, Delhi, 1995
- b) Structural Analysis – A Matrix Approach – G.S.Pandit & S.P.Gupta, Tata McGraw-Hill, 1998
- c) Bairagi N K, A text book of Plate Analysis, Khanna Publishers, New Delhi, 1996.
- d) G.S. Ramaswamy, Design and Construction of Shell Structures, CBS Publishers, New Delhi, 1996
- e) S. Timoshenko & S. Woinowsky – Krieger, “Theory of Plates and Shells”, McGraw Hill Book Company.

ECV 515: Structural Design IV [Studio]

Prerequisite: ECV 501: Structural Design III

Objective

The objective of the course is to equip the student with knowledge on various aspects of structural design.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Design multi-storey buildings in concrete, steel and timber
2. Design structures to resist dynamic loading

3. Use computers in analysis design and detailing

Course Description

Multi-storey buildings and multi-span bridges in concrete, steel and timber. Design of structures to resist dynamic loading. Use of computers in structural analysis, design and detailing. Design of multi-storey buildings in concrete, steel and timber.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% where 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

1. Textbooks:

- a) Varghese P C, Limit State Design of Reinforced Concrete, Prentice Hall of India, Private, Limited New Delhi, 1997
- b) Dayaratnam P, Brick and Reinforced Brick Structures, Oxford & IBH Publishing Company Private Limited 1997
- c) Subramanian N., Design of steel structures, Oxford University Press, New Delhi, 2008.
- d) Duggal S.K., Limit state design of steel structures, Tata McGraw Hill publishing Pvt. Ltd., New Delhi, 2010.

2. References

- a) Mallick and Gupta, Reinforced Concrete Design, Oxford and IBH, Delhi, 1997
- b) Design Aides to IS 456-1978 (SP-16)
- c) Code of Practice for Plain and Reinforced Concrete – IS456-2000
- d) Krishna Raju N, Structural Design and Drawing (Reinforced Concrete and Steel), University Press (India) Pvt. Ltd., Hyderabad, 2009.
- e) Krishnamurthy D, Structural Design and Drawing – Vol. II (Concrete Structures), CBS Publishers and Distributors, New Delhi 1992.
- f) Krishnamurthy D, Structural Design and Drawing – Vol. III (Steel Structures), CBS Publishers and Distributors, New Delhi, 1992.

ECV 516: Mechanics of Composite Materials

Prerequisites: ECV 501: Structural Design III ECV 412: Structural Design II

Objective

The objective of the course is to equip the student with knowledge on the design of composite materials

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Know the different types of composite materials and their applications.
2. Know the properties of existing composites
3. Laminate: manufacture composite materials
4. Give safety margins.
5. Know various load conditions.

Course content

Types of composite materials such as fibre-reinforced concrete, ferrocement, plywood, glue-laminated timber and laminated plastics and their applications. Properties of existing composites: thermal, mechanical and ply properties. Composite macro-mechanics: ply uniaxial analysis, transformation, failure criteria, behaviour under combined stresses. Laminate: manufacture; fabrication process. Storage conditions. Laminate Properties: thermal and mechanical; residual stresses, warpage. Laminate Analysis: configuration, interply contribution, transformation, behaviour under combined stresses, failure mechanisms, failure criteria. Safety margins. Structural analysis. Boundary conditions. Load conditions: static, cyclic and impact.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

40% Continuous Assessment: 60% Design Project.

Practical work and Design Projects

Student will carry out structural design projects in groups. Each student is required to write his/her own report for marking. Part of the practical work shall include conducting the experiments indicated below.

Practical work/Laboratory Exercises

1. Reinforcement bar tensile test
2. Reinforced concrete beam testing in flexure.

Textbooks and References

1. Textbook:
 - (a) Jack McCormac; Design of reinforced concrete. Wiley 7th ed., 2005. ISBN:047176132X
2. References
 - (b) Chu-Kia Wang and Charles G. Salmon; Reinforced Concrete Design. Wiley 6th ed., 1998. ISBN:0471364223

ECV 517: Design of Bridges

Prerequisites: ECV 404: Structural Design I

Objective

The objective of the course is to equip the student with knowledge on the design of bridges

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Differentiate different types of Bridges
2. Plan location of Bridges
3. Design of bridges
4. Use BS 5400, BS 6399, ICE (Institute of Civil Engineers Manual) and CP3 or other applicable standard/manual in design of bridges.

Course description

Types of Bridges: Simply supported bridges, Prestressed concrete bridges, composite beam bridges, Plate Girders, box Girders, arch bridges, Cable stayed bridges, suspension Bridges. Planning and location of Bridges. Design of bridges using materials such as orthotropic plates, other systems in steel, structural steel, composite construction. Inspection, preventive maintenance and repair of bridges. Emphasis shall be laid on structural analysis, design and detailing exercises. The course shall be based on the following codes of practice: BS 5400, BS 6399, ICE (Institute of Civil Engineers Manual) and CP3 or other applicable standard/manual.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70 %. Continuous Assessment 30 %.

References

Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

Transportation and Highway Engineering (Option 3)

ECV 508: Coastal Engineering

Prerequisites: ECV 410: Foundation Engineering II, ECV 412: Structural design II

Objective

The objective of the course is to impart basic knowledge on tides and waves, harbor engineering and marine structures.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Describe types of tides and their effect on the coast
2. Describe the theory of current
3. Identify different types of waves and their effect on marine structures
4. Determine the location of a harbor
5. Design simple marine structures

Course Description

Tides: types of tides, tide levels, effect of tides on the coast. Currents: theory of currents, origin of current, effects of current such as land accretion and erosion. Wind: wind force, predominant wind direction. Waves: types of waves and wave patterns, the effect of wind and fetch, the mechanism of a wave, significant wave height, the force of a wave on marine structures. Effect of marine constructions on waves, current and sedimentation. The combined effect of wind and waves. Harbour engineering: importance of seaports in the communication system, location of harbour, accessibility, layout of a harbour. Design of marine structures: docks, berths, breakwaters, jetties, landing stages, quays considering quality of materials and durability of the structure. Maintenance aspects with special attention to protection of marine structures against aggressive marine environment.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70 % Continuous Assessment: 30 % of which 10 % shall be continuous assessment tests and 5 % shall be assignments and 15 % shall be for laboratory exercises.

Practical work/Laboratory Exercises

References

Journals and on-line materials (provided by KU Library)

- a) Africa journals online, Agora, Cambridge journals, OARE, Oxford journals, Wiley Interscience UNESCO publications
- b) Ebrary, Springerlink, Data World Bank

ECV 518: Pavement Design

Prerequisites: ECV 409: Highway Engineering II, ECV 401: Highway Engineering I and ECV 403: Foundations Engineering I

Objective

The objective of the course is to impart knowledge on pavement design methods

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Learn the different types of pavements
2. Appreciate the functions of pavement layers, behaviour of layered systems under wheel loads
3. Learn stresses in flexible and rigid pavements
4. Use the Kenya Department of Roads Design Manual part III in design of pavement
5. Design of rigid pavements
6. Know methods of evaluating pavement maintenance needs and strengthening of pavements

Course Description

Types of pavements: Flexible pavements, rigid pavements. Functions of pavement layers, behaviour of layered systems under wheel loads. Stresses in flexible and rigid pavements, factors affecting stress distribution in flexible and rigid pavements. Introduction to empirical and semi-empirical. Design of flexible pavements: CBR method, Group index, Road Note 31, The Kenya Department of Roads Design Manual part III - Materials and Pavement Design. Analytical concepts of pavement design. Design of rigid pavements: The Road Note 29 method. Drainage design for Highways. Introduction to pavement construction. Labour intensive low-cost road construction. Methods of evaluating pavement maintenance needs and strengthening of pavements.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% of which 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at the experiments listed below.

1. Determination of construction material CBR value
2. Determination of the ductility of the material
3. Determination of the Marshall index

Textbooks and References

1. Textbook:

(a) Paul H. Wright and Karen Dixon; Highway Engineering. Wiley, 7th ed., 2003. ISBN:047126461X

2. References

(a) Traffic and Highway Engineering, Nicholas J. Garber and Lester A. Hoel, Cengage-Engineering; 4 edition (2008) ISBN-10: 0495082503

ECV 519: Transportation, Urban and Regional Planning

Prerequisite: ECV 406: Transportation Engineering

Objective

The objective of the course is to equip the student with knowledge on the interaction between transport, land use and planning.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Demonstrate how transportation investments can be consistent with the principles and practices of land use planning and development
2. Evaluate how land use decisions effect the transportation system
3. Be aware of the effects the existing and future transportation systems may have on land use development demand, choices, and patterns
4. Describe the components of urban dynamics
5. Apply urban land use models

Course Description

Transportation and land use interactions; Models; historical perspectives; travel demands; location theory. Technology and impacts of transportation. Centralized verses decentralized systems. The shaping of patterns of settlements economy by transportation innovation: Transportation and regional planning and development.

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 2 hours per week.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% where 20% shall be continuous assessment tests and 10% shall be assignments.

Textbooks and References

Text Books

- a) Urban Transit: Operations, Planning, and Economics / Edition 1 *by* Vukan R. Vuchic
- b) Urban Transportation Planning. Michael Meyer, Eric Miller
- c) Transport Planning in Third World Cities. H.T. Ditiou

References

- a) Cities of Tomorrow: An Intellectual History of Urban Planning and Design in the Twentieth Century. Peter Hall
- b) The Economics of Urban Transportation. Kenneth Small, Erik Verhoef

ECV 520: Urban Traffic Management

Prerequisite: ECV 409: Highway Engineering II ECV 401: Highway Engineering I and ECV 403: Foundations Engineering I

Objective

The objective of the course is to impart knowledge on urban traffic management.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Describe different types of traffic flow
2. Describe traffic control systems
3. Demonstrate the need of safety in roads
4. Demonstrate understanding of environmental considerations; noise, vibration and air pollution in roads

Course description

Traffic flow: one-way streets, tidal and reversible flows and turning traffic. Traffic control systems: Traffic signals, road signs and marking, street lighting and grade separation. Parking: parking studies, off street parking and location, peripheral; parking, functional design of off street car parking and lorry parking. Safety; accident statistics, factors contributing to accidents, protection of cyclist and pedestrian through the use of; cycle routes, tracks and lanes. Environmental considerations; noise, vibration and air pollution

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% of which 10% shall be continuous assessment tests and 5% shall be assignments .

Practical work/Laboratory Exercises

Textbooks and References

1. Textbook:

- a) Paul H. Wright and Karen Dixon; Highway Engineering. Wiley, 7th ed., 2003. ISBN:047126461X

2. References

- a) Traffic and Highway Engineering, Nicholas J. Garber and Lester A. Hoel, Cengage-Engineering; 4 edition (2008) ISBN-10: 0495082503

ECV 521: Advanced Engineering Surveying

Prerequisite: ECV 311: Surveying IV

Objective

The objective of the course is to introduce remote sensing and GIS and their application in Civil and Water resources engineering.

Expected Learning Outcomes

Upon completion of this course the student will be able to:

1. Describe the functions of remote sensing tools
2. Use remote sensing in the identification of required site characteristics.
3. Describe the process of data acquisition for GIS
4. Use GIS software for data processing and application
5. Apply and present GIS information.

Course description

Mine, tunnel and hydrographic survey techniques. Remote sensing: air photography concepts, flying for aerial photography and ground control, parallax measurements, theory of mapping from aerial photographs, satellite remote sensing. Stereo-mapping from satellite and aerial remote sensing and the applications in civil and structural Engineering , such as highways, pipelines, channels, dams, geological mapping. Geographical Information systems (GIS): concepts and applications, and the relationship between remote sensing and GIS: Global positioning system and Differential Global Position system (DGPS); theories and applications in civil and structural Engineering. The concepts of Gauss-Markov model for adjustment of observations in GPS and DGPS observations

Mode of Delivery

Lectures: 2 hours per week; Tutorials: 1 hour per week and 3 hours per week Laboratory work.

Assessment

Ordinary Examination at end of Semester: 70%; Continuous Assessment: 30% of which 10% shall be continuous assessment tests and 5% shall be assignments and 15% shall be for laboratory exercises.

Practical work/Laboratory Exercises

Each student is required to conduct at least four computer laboratory exercises based on Remote sensing Softwares such as Erdas Imagine-9 and data based on Kenya.

Each student is required to conduct at least four computer laboratory exercises based on GIS softwares such as ArcGIS.

Textbooks and References

1. Textbook:
 - a) Jensen John R.; Remote sensing of the environment: An earth Resource perspective.

Prentice-Hall, 2nd ed., 2007. ISBN:

b) Paul Longley, Michael F. Goodchild, David Maquire and David Rhind; Geographical Information Systems and Science. Wiley 2nd ed., 2005. ISBN:047087001X

2. References

Thomas M. Lillesand, Ralph W. Kiefer and Jonathan W. Chipman; Remote sensing and image interpretation. Wiley, 5th ed., 2005. ISBN:0471152277

4.0 CURRICULUM DESIGN

4.1 Summary Specifications of Curriculum

Table 1 summarises bundles of courses that should be covered in the Education/Training of Civil Engineer to be able to perform the tasks defined in Table 1.

Table 1: Summary Specifications of Curriculum

	Subject Title	Hours Spent in Year of Study						
		1	2	3	4	5	AU	Total
1.	Natural Sciences (Mathematics & Basic and Applied Sciences)						840	872
2.	Complimentary Studies						450	506
3.	Engineering Sciences and Engineering Design						2100	2968
							3400	4295

4.2 Distribution of Civil Engineering Courses

Mathematics & Basic Sciences (872 Hrs)

	Subject Title	Hours Spent in Year of Study						
		1	2	3	4	5	AU	Total
1.	Engineering Mathematics I to X (ECU 104, 105, 106, 107, 200; 201; 202; 203; 300; 301)	192	192	112				480
	Total Basic Mathematics						390	480
2.	Physics (ECU 101, ECU 103)	70						70
	Laboratory Hours	42						42
3.	Chemistry (ECU 100, ECU 102)	70						70
	Laboratory Hours	42						42
4.	Public Health Engineering I & II (ECV 303 & ECV 310)			70				70
	Laboratory Hours			42				42
5.	Material Science (ECV 101)	35						35
	Laboratory Hours	21						21
	Total Basic Sciences						390	392
	Total Mathematics and Basic Sciences						840	872

Complimentary Studies (506 Hrs)

	Subject Title	Hours Spent in Year of Study						
		1	2	3	4	5	AU	Total
1.	Communication Skills (UCU 100)	35						35
2.	Development Studies (UCU 101)	35						35
3.	Introduction To Creative & Critical Thinking (UCU 103)	35						35
4.	Introduction To Engineering Profession (ECU 108)	49						49
5.	Fundamentals Of Computing (ECU 109) Computer programming (ECV 102)	112						112
6.	Innovation & Entrepreneurship for Engineers (ECU 302)			48				48
7.	Research Methodology (ECU 400)				48			48
8.	Project Management (ECU 401)				48			48
9.	Engineering Economics (ECU 402)				48			48
10.	Engineering Profession Practice & Ethics (ECU 500)					48		48
	Total Complimentary Studies						450	506

Engineering Sciences (1568 Hrs)

	Subject Title	Hours Spent in Year of Study						
		1	2	3	4	5	AU	Total
1.	Surveying I, II, III & IV (ECV 201, 206, 304 & 311)		112	112				224
2.	Computer Programming I (ECV 102)	56						56
3.	Fluid Mechanics I & II (ECV 202, ECV 207)		112					112
4.	Strength of Materials I & II (ECV 203, ECV 208)		112					112
5.	Theory of Structures I, II, III, IV & V (ECV 204, 209, 305, 312, 405)		112	112	56			280
6.	Civil Engineering Materials I & II		112					112

	(ECV 205 & 210)							
7.	Electromechanical Engineering (ECV 211)		56					56
8.	Engineering Geology (ECV 300)			56				56
9.	Soil Mechanics I & II (ECV 301 & 308)			112				112
10.	Hydraulics I & II (ECV 302 & 309)			112				112
11.	Hydrology I & II (ECV 307 & 407)			56	56			112
12.	Transportation Planning & Development (ECV 306)			56				56
13.	Highway Materials (ECV 503)					56		56
14.	Construction Management (ECV 504)					56		56
15.	Civil Engineering Practice (ECV 509)					56		56
	Total Engineering Sciences						900	1568

Engineering Design (1400 Hrs)

	Subject Title	Hours Spent in Year of Study						
		1	2	3	4	5	AU	Total
1.	Engineering Drawing I & II (ECV 100, ECV 200)	56	56					112
2.	Traffic Engineering I & II (ECV 400 & 408)				112			112
3.	Highway Engineering I & II (ECV 401 & 409)				112			112
4.	Structural Design I, II & III (ECV 404, 412 & 501)				112	56		168
5.	Irrigation Engineering I & II (ECV 402 & 410)				112			112
6.	Transportation Engineering I (ECV 406)				56			56
7.	Foundation Engineering I & II (ECV 403 & 411)				112			112
8.	Public Health Engineering III (ECV 506)					56		56
9.	Water Resources Engineering I (ECV 502)					56		56
10.	Environmental Engineering (ECV 505)					56		56
11.	Design & Construction of Dams (ECV 522)					56		56
12.	Civil Engineering Project I & II (ECV 500 & 523)					112		112
13.	Geotechnical Engineering (ECV 507)					56		56
14.	Logistics & Systems Analysis in Transportation (ECV 510)					56		56
15.	3 Electives					168		168
	Total Engineering Design						900	1400

4.3 Laboratories

Laboratories	Current	Projections			
	2014	2015	2016	2017	2018
Structural Engineering Labs					
• Concrete Technology Lab	0	1	1	1	1
• Heavy Structures Lab	0	0	1	1	1
Water Resources Engineering Labs					
• Hydraulics Engineering and Fluid Mechanics	0	1	1	1	1
• Environmental Engineering Lab	1	1	1	1	1
Transportation Engineering Labs					
• Highway Materials Lab	0	1	1	1	1
• Traffic Engineering Lab	0	0	1	1	1
• Transport Planning Lab	0	0	0	1	1
Geotechnical Engineering Labs					
• Soil Mechanics Lab	0	1	1	1	1
• Geo Textile & Geo Synthetics Lab		0	1	1	1
Remote Sensing Labs					
• Global Positioning System Lab	0	0	1	1	1
• Photogrammetry and Remote Sensing Lab	0	0	0	1	1
• Surveying Lab	0	0	0	1	1
Computational Labs	0	1	1	1	1

4.4 Analysis of Academic Staff

Post	Establishment	Projections			
		2013	2014	2015	2016
Professor	3	0	0	1	3
Associate Professors	4	0	0	2	4
Senior Lecturers	9	0	0	4	9
Lecturers	28	12	12	20	28
Tutorial Fellows	8	0	0	6	8

4.5 Analysis of Support Staff

Post	Establishment	Projections			
		2013	2014	2015	2016
Chief Technicians	2	1	1	2	2
Senior Technicians	3	0	0	2	3
Technicians	3	1	1	3	3
Computer Lab Technicians	1	0	0	1	1