German University in Cairo

Faculty of Media Engineering and Technology (Computer Science and Engineering)

Syllabus and Curriculum 2019

Abbreviations:
L = Lecture; E = Exercise; P=Practical (research/programming); CP = Credit Point

1st Semester

Code	Nr	Course Title	L	E	P	CP
CSEN	102	Introduction to Computer Science	2	2	2	6

Prerequisite Courses

None

Course Outline

The course is an introduction to fundamentals of Computer Science. The purpose of this course is to gain a broad oversight of the discipline of formal computer science. This will allow the students to, not only use computers and software efficiently, but to understand the ideas underlying their creation and implementation. Students will be able to understand fundamental issues as algorithms, hardware design, computer organization and system software.

Course Outcome

At the end of this course, the student will be able to:

- Identify the basics of computer science
- Express problem solutions in the form of algorithms using pseudo-code
- Implement simple algorithms using a programming language
- Analyze algorithms in term of efficiency
- Identify basic concepts in data representation and manipulation
- Build simple computer circuits using Boolean logic
- Relate the concepts gained to understand the Von Neumann architecture
- Identify basic issues related to the software systems

References and Textbooks

- **Invitation to Computer Science: Java Version**
  G. Michael Schneider, Sara Baase, Judith L. Gersting
  ISBN: 0534374883
- **Computer Science: an Overview**
  J. Glenn Brookshear
  ISBN: 0201781301

Code	Nr	Course Title	L	E	P	CP
MATH	103	Maths	4	4	0	8

Prerequisite Courses
None

Course Outline

The course is designed to introduce the engineering students to Calculus as a basic tool of mathematics that they will need for their studies as engineers.

It starts by emphasizing the Pre-Calculus concepts that the students are expected to have studied in their high school. Parts of these basic concepts are real numbers, inequalities, absolute values, trigonometry, complex numbers, functions, and graphs of functions. Functions are introduced as mappings and classified as unique transforms between sets. Next continuity of function is introduced. The composition of function establishes the generation of new types of functions. The students then study the concepts of the limit process. The limits are used to introduce differentiation as a geometric and analytic tool. Basic differentiation rules are derived from this fundamental concept which leads to the differentiation of polynomials, trigonometric functions, exponentials and logarithms.
In addition to differentiating special functions general rules like the chain rule, implicit differentiation, multiple differentiation, and linear approximation of functions are the topics covered in the differentiation part. The application of differentiation to find local and global extreme values follows next. In this context the mean value theorem, limits at infinity and optimization in single variable are discussed. A special numerical procedure related to first order derivatives is Newton's method of finding roots of equations. Inverse operations to derivatives, so called anti-derivatives or integrals are introduced using limits and Riemann sums. The basic rules of integration are discussed and demonstrated by examples. Different basic techniques like integration by parts, integration using partial fractions, integration using substitutions etc. are presented. Applications of integration on curves and surfaces are part of the course.

Course Outcome

At the end of the course the student should be able to use mathematical tools such as equations, functions, derivatives, and optimization to solve engineering problems.
The aim of the course is to make the students achieve equal level coming from different schools. At the end of the course the students should be familiar with differentiation and its application for optimisation as well as techniques in integration.

Textbooks

- J. Stewart, **Calculus,** Books/Cole-Thomson Learning, Belmont, 2003

Code	Nr	Course Title	L	E	P	CP
CHEMt	102	Chemistry	2	2	0	4
CHEMp	102	Chemistry	0	0	2	2

Prerequisites
None

Course Outline
The course introduces to the modern atomic models including a description of chemical bonding in molecules, metals, and ionic solids. The principles underlying the periodic table of elements are derived. A further section is devoted to the stoichiometry of chemical reactions. Finally, an introduction to electrochemistry chemistry and chemical kinetics are given.

Course Learning Outcomes
The students will get an overview on the general principles of chemistry. The course will allow them to drive macroscopic properties of molecules from their structures and electronic properties. Furthermore, the students will be able to balance chemical equations and to understand the basic applications of chemical reactions such as reactions of lead-acid battery.

Textbook and References
- S.S. Zumdahl, S.A. Zumdahl, Chemistry 6th Ed., Houghton Mifflin Company, ISBN 0-618-22156-5
- W.L. Masterton, C.L. Hurley, Chemistry, Principles and Reactions 5th Ed., Thomson Books/Cole, ISBN 0-534-40881-8

Code	Nr	Course Title	L	E	P	CP
AE	101	Academic English	0	6	0	2

Prerequisites
Satisfying the GUC's required score on the English Academic Aptitude Admission Exam

Course Outline
Introduction to Academic English is a course catering for the language needs of students who are able to function in an academic environment but have certain deficiencies in oral/written communication.
The course is designed to brush up on basic language and academic skills.
It highlights the importance of improving the different language skill areas of listening, speaking, reading and writing as well as the language content of grammar and vocabulary. All skills are integrated and presented in an academic context. Students learn to write paragraphs, read critically, listen to lectures and take notes, use grammar effectively, and become more effective learners.

Course Outcome
A. Writing
- Applying the writing process
- Formulating a well-constructed paragraph
- Writing a well- constructed essay

B. Reading
- Skimming for main ideas
- Identifying implied main ideas
- Scanning for specific information
- Differentiating between main and supporting ideas
- Using clues to determine the meaning of new words
- Distinguishing fact from opinion
- Making inferences based on info in the passage

C. Listening/Speaking

Listening
- Comprehending conversations and long discussions in social and academic contexts and academic lectures
- Understanding culturally appropriate expressions of:
- Taking and organising notes that could be used as the basis for class discussion and activities

Speaking
- Speaking fluently and comprehensively in social and academic contexts
- Practicing spoken language through interview simulation
- Demonstrating acquired speaking skills through small group presentations

D. Grammar
- Understanding the difference between the meaning, form and use of different grammatical forms
- Speaking grammatically
- Writing grammatically
- Using grammar in understanding academic texts

Learning outcomes:

I. Given a topic, students will be able to:
A. Generate ideas with an accuracy level of 90%.
B. Organize their ideas into a structured outline with an accuracy level of 90%.
C. Produce a coherent paragraph made up of a topic sentence, supporting details, and a conclusion with an accuracy level of 85%.
D. Use correct sentence structure, appropriate vocabulary, and appropriate transitions in writing with an accuracy level of 85%.
E. Produce a coherent well written academic essay with an accuracy level of 70%

II. Given an academic passage of 400 – 600 words, students will be able to:
A. Recognize main ideas with an accuracy level of 100%.
B. Identify specific details with an accuracy level of 100%.
C. Recognize implied main ideas with an accuracy level of 100%.
D. Distinguish between main ideas and supporting details with an accuracy level of 95%.
E. Identify meaning of vocabulary from context with an accuracy level of 90%.
F. Distinguish fact from opinion with an accuracy level of 100%.
G. Make inferences with an accuracy level of 100%

III. A. Given a mini-lecture or a long conversation, students will be able to:
1. Identify the topic with an accuracy level of 100%.
2. Recognize the main idea with an accuracy level of 100%.
3. Identify specific info with an accuracy level of 100%.
4. Identify pros and cons with an accuracy level of 100%.
6. Comprehend speech acts with an accuracy level of 100%.
7. Take notes about the lecture with an accuracy level of 85%.

B. Given a situation, students will be able to:
1. Produce fluent, comprehensible, accurate spoken English in presentations with an accuracy level of 90%.
2. Produce fluent, comprehensible, accurate spoken English in interviews with an accuracy level of 90%.

References and Textbooks

• Oshima, A. and Hogue, A. (1999). Writing Academic English (3rd ed).
New York: Longman.
Reading, Listening, Speaking, and Grammar Course book: Compiled Material.

Code	Nr	Course Title	L	E	P	CP
AS	102	Academic Study Skills	0	4	0	2

Prerequisites
Satisfying the department's required score on the English Placement Diagnostic Exam, or successfully fulfilling the academic requirements of the Academic English Course

Course Outline
A.S is a course with a structured approach to academic reading and writing. It trains students to look at topics from various points of view leading to a more advanced way of organizing ideas and writing about them in a structured, coherent way. It enhances critical reading and academic writing skills.

Course Outcome
Upon completing this course, the students should be able to:
1. Present their arguments in a well structured academic written form.
2. Critically read an academic text.
3. Paraphrase, summarize and synthesize a variety of academic texts.

I. Given an academic topic, students will be able to:
a. Generate ideas using pre-writing techniques with an accuracy level of 90%
b. Organize their ideas into a structured outline with an accuracy level of 90%
c. distinguish between good and bad arguments with an accuracy level of 85%
d. produce a 4-6 paragraph argumentative essay made up of an introduction, a body, and a conclusion with an accuracy level of 85%
e. Use correct sentence structure and appropriate vocabulary in writing with an accuracy level of 85%
II. Given an academic text of 500-1000 words, students will be able to:
a. Recognize main ideas with an accuracy level of 100%.
b. Distinguish major from minor details with an accuracy level of 100%.
c. Recognize organizational patterns with an accuracy level of 100%.
f. Draw inferences about main ideas with an accuracy level of 100%.
j. Draw inferences about supporting details with an accuracy level of 100%.
k. Identify the meaning of difficult vocabulary from context with an accuracy level of 100%.
l. Identify details with an accuracy level of 100%.
III. Given an academic text of 200 – 300 words, students will be able to:
a. Recognize the most accurate paraphrase of the text with an accuracy level of 100%.
b. Paraphrase the text with an accuracy level of 85%.
IV. Given an argument , students will be able to:
a. analyze it with an accuracy level of 95%.
b. Criticize it with an accuracy level of 85%
V. Given several academic texts of 300 – 500 words about a given topic, students will be able to:
a. Recognize the most accurate summary with an accuracy level of 100%.
b. Summarize the text with an accuracy level of 85%.

VI. Given several academic texts of 300 – 500 words about a given top Students will be able to:

a. Recognize the most accurate synthesis of the texts with an accuracy level of 100%.
b. Synthesize with an accuracy level of 80%.

References and Textbooks

• Flemming L.: Reading for Thinking. 5th Ed. Boston: Houghton Mifflin Company, 2006.

Code	Nr	Course Title	L	E	P	CP
HUMA	101	German Language I	0	4	0	3

Prerequisites
None

Course Outline
The course offers basic German to beginners without any previous knowledge.
Grammar: Conjugation in the present tense
Addressing people formally and informally
Word order for sentences and questions
Use of definite and indefinite articles in the nominative and accusative cases
Singular- and plural-forms

Topics: General information on persons
Orientation in a foreign city
Music

Reading: Understand simple information in a text
Understand information in a map
Understand international words
Understand "W"-questions in a text

Writing: Write a short text about a person (name, address, age, nationality, foreign languages, studying, lecture schedule

Listening: To perform listening comprehension tasks

Course Outcome
By the end of this course, the student will be able to
- write a short text (50 words)
- write a short dialogue
- understand and apply numbers, dates, weekdays, months, international words
- fill out forms
- ask and answer questions
- state an opinion
- perform listening and reading comprehension tasks

References and Textbooks
- Optimal A 1, Chapter 1 – 3 (course book and workbook)

supplementary material and vocabulary lists on the intranet under the link: V:\Faculties\Language Centre\German
(Active vocab.: bold-faced words; passiv voc. : normal-typed words)

Code	Nr	Course Title	L	E	P	CP
PHYS	101	Physics	3	2	0	5

Prerequisites
None

Course Outline
The course introduces a calculus-based study of, Newtonian Mechanics; introduction to vector algebra; space and time straight-line kinematics; motion in two dimensions; the concept of force; Newton's laws; forces of friction; mechanical equilibrium, uniform and non uniform circular motion; motion in accelerated frames; work and energy; conservative and neoconservative forces; potential energy; linear momentum; collisions and conservation laws; rigid body and rotational dynamics; angular momentum; universal gravitation; elasticity; fluid mechanics; oscillatory motion

Course Outcome
The purpose of this course is to enable the student to learn the laws of mechanics, oscillatory and wave motion; and heat and thermodynamics; to see how they can be applied to explain many physical phenomena observed around us, and understand how it can be applied to build or improve devices that are beneficial to people

As a result of successfully completing this course, the student will be able to do the followings:

- demonstrate concepts of physics by performing satisfactorily on homework and tests;
- solve problems by applying the laws physics and the tool of math.;
- demonstrate communication skills by answering questions in class, writing reports. and turning in homework;
- show teamwork capabilities by working in group
- apply the scientific method in analyzing natural physical phenomena in the universe;
- demonstrate professional and ethical responsibility through class attendance.

References and Textbooks
- **Physics for Scientists and Engineers**, 6th edition, Serway & Jewett, (Thomson Brooks/Cole Publ).

Code	Nr	Course Title	L	E	P	CP
EDPT	201	Production Technology	1	0	2	3

Prerequisites
None

Course Outline
The course is designed to provide engineering students with an understanding of the methods and procedures used for the production of goods. It is a basic course to produce manufacturing processes such as manual material removal, machining, forming, welding and casting. It includes a workshop to provide students with manual manufacturing processes as well with machining. In addition the course gives a broader view into the business world related to product management.

Course Outcome
In the various fields of engineering a fundamental knowledge of the production technology is needed and the students' understanding of the principles of the product cycle from the raw material up to the manufacturing of the developed products will be promoted. The course also will provide an insight into business connections that future managers of all engineering fields should have.

The workshop will facilitate the skills in handicraft and give the students a broader feeling for the material used and their properties.
Students will confidently use tools for the manual manufacturing process.
They will be able to distinguish between the different types of production processes and methods of technical products. They will get a basic knowledge about the relation between the production, business world and society.

The learning objectives are divided into 6 units:
- management- product and quality
- safety
- manual methods of material removal
- machine manufacturing
- joining technologies
- measurement and quality

References and Textbooks

- E. Paul DeGarmo; J. T. Black; Ronald A. Kohser: **Materials and processes in manufacturing / With computer interactive exercises** by Barney E. Klamecki, 9th edition, Hoboken, NJ : Wiley, 2003

2nd Semester

Code	Nr	Course Title	L	E	P	CP
MATH	203	Mathematics I	4	4	0	8

Prerequisite Courses
Math 103

Course Outline
The course continues the topics in calculus of a single variable. Infinite sequences, series and series expansions like Taylor and Maclaurin expansions are the basis of approximations and solution strategies for first and second order differential equations.
The next step is to generalize the framework of calculus by general concepts from linear algebra. The basic elements like vectors and matrices are introduced. Applications of these objects are discussed to represent linear systems of equations. The different solution strategies for linear systems of equations are presented and the advantages of the solution approaches shown. Based on these techniques the general structure of a linear vector space is introduced and consequences derived for the solution strategies. In addition linear transformations, eigenvalues, eigenvectors as well as the spectral theorem are used in applications. The theoretical structure of linear vector spaces is extended to functions and applications for linear difference and differential equations.

Course Outcome
Students should be able to apply the concepts of calculus and linear algebra.
At the end of the course, they should know the following subjects:

- Infinite Sequences and Series
- Taylor and Maclaurin Expansions
- First and Second Order Differential Equations
- Vectors and Matrices in Linear Spaces
- Linear Systems of Equations
- Eigenvalues and Eigenvectors with Applications
- Structure of a Linear Vector Space and their Consequences

Textbooks

- J. Stewart, **Calculus,** Books/Cole-Thomson Learning, Belmont, 2003
- **Linear Algebra: A Modern Introduction**, 2nd edition, by D. Poole, Brooks/Cole-Thomson Learning, Belmont, 2006

Reference Books

- E. Kreyszig, **Advanced Engineering Mathematics**,, J. Wiley & Sons, 1999
- **Shaum's Outline of Advanced Mathematics for Engineers and Scientists**, 1st edition, by M.R. Spiegel, McGraw-Hill, 1971

Code	Nr	Course Title	L	E	P	CP
PHYS	202	Physics II	3	2	0	5

Prerequisites
PHYS 101

Course Outline

This course is the second part in the series of Physics courses at the GUC for Engineering students. It will cover the complex "Electricity and Magnetism". The course will deepen the existing knowledge in these fields in two directions. One is the understanding of the fundamental models in the fields mentioned above and the physicists' way to describe and analyze the world. The second one is to show where and how the fundamental discoveries are present in the world around us, either natural or in man-made forms.

Textbook examples will offer students a way towards the application of the new knowledge, which shall finally enable them to discover and analyze the Physics present in the world around.

The major conceptual topics of the course will be:

- electric charges, forces and fields, Gauss' law, electric potential, capacitors and dielectrics, electric current and resistance.

- magnetic fields and their sources, Faraday's law of induction and Lenz' law, inductors, motors and generators, direct and alternating current circuits

Course Outcome

In the course students will acquire comprehensive knowledge of the fundamental physical principles in the fields covered in the course as well as their mathematical description. They will learn how to apply these principles to the analysis of simple problem settings and how to use the formulas for the solution of the problems.

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

- Describe the basic concepts, laws and models in the fields of the course, and have a sound knowledge about the limitations of these concepts,
- Describe relevant physical quantities and distinguish between related quantities,
- Identify the underlying concepts in text-book and simple real-world situations,
- Use these principles to analyze such situations, including situations which students did not encounter before,
- Convert text, graphic and numerical representations for a given physical problem,
- Apply mathematics in order to simplify, quantify and apply the physical principles,
- Estimate a physical quantity or numerical result to check its plausibility.

References and Textbooks

- **Serway and Jewett: Physics for Scientists and Engineers, with Modern Physics** Thomson Brooks/Cole.

Code	Nr	Course Title	L	E	P	CP
SM	101	Critical Thinking & Scientific Methodology	0	2	0	1.5

Prerequisites
Satisfying the department's required score on the English Placement Diagnostic Exam, or successfully fulfilling the academic requirements of the Academic Study Skills English Course.

Course Outline
The course teaches the basic skills of analyzing information. Attention is given specially to scientific thinking skills — problem solving, observation, analysis, inferencing, interpretation, and argumentation in both reading, oral and written expression. In addition, to designing a questionnaire and producing a report based on a problem.

Course Outcome
Upon completion of the course, students will be able to:
- Apply the steps of scientific method to solve a problem.
- Make scientific observations.
- Describe their observations.
- Distinguish between positive and negative connotations.
- Distinguish among observations, facts, opinions, inferences, and assumptions.
- Make inferences from premises.
- Recognize good arguments.
- Detect faulty arguments.
- Report on how they would provide a hypothesis for a given problem in any field of study.
- Identify parts of report writing based on a problem and give a hypothesis.
- Produce a business report based on a problem and provide a hypothesis
- Distinguish among different types of questions in questionnaire writing.
- Produce a questionnaire based on a problem and testing the validity of the given hypothesis
- Analyze information gathered through a questionnaire to confirm or reject the hypothesis.

References and Textbooks
Mayfield, M.(2004). Thinking for Yourself (6th ed.). Boston: Thomson Heinle.

Code	Nr	Course Title	L	E	P	CP
HUMA	201	German Language II	0	4	0	3

Prerequisites
Successful completion of German Language I

Course Outline
The course offers basic German to beginners with some previous knowledge
Grammar:

- recognize and use separable verbs in a sentence
- negate sentences by using “nicht” and “kein”, “keine“, “keinen“
- understand and use the modal verbs “können”, “müssen”, “wollen”, “möchten”, “dürfen” in the present tense
- understand and use articles and nouns in dative
- understand and use prepositions followed by dative
- give orders using the formal and informal imperative form

Listening / Reading:

- perform listening and reading comprehension tasks using the techniques of selective / global listening and reading

Writing:

- write paragraphs and dialogues of at least 50 words

Topics:

- Work and Spare-time
  Food and Drinks in Restaurants and Shops
  Studying and reflecting on the learning process

Course Outcome
By the end of this course, the student can

- describe a daily routine
- tell the time
- pose and answer questions on professions
- write an invitation
- make a shopping dialogue
- order and pay in a restaurant
- talk about learning languages
- introduce himself in an e-mail

using the grammar and vocabulary listed.

References and Textbooks

- Optimal A 1, Chapter 4 - 6

+ supplementary material and vocabulary lists of the relevant chapters on the intranet

- bold-typed words: active vocabulary:
  students have to know the meaning, spelling, article and plural

- all other words: passive vocabulary:
  students have to know the meaning only

Code	Nr	Course Title	L	E	P	CP
CSEN	202	Introduction to Computer Programming	2	2	2	6

Prerequisite Courses
None

Course Outline

This course is designed to teach students the basics of computer Programming in an object-oriented framework and using Java as a programming language example for learning software writing skills. Java includes a lot of facilities that satisfies the requirements for developing high scale, secure and maintainable software.

Topics covered in the course

- Fundamental Data Types
- Decisions and Iterations
- Methods and Recursion
- Classes and Objects
- Arrays

References and Textbooks

- **Introduction to Computer Science and Programming, 3rd edition**
  Walter Savitch
  ISBN: 0131217275

Recommended Textbook

- **Computing Concepts with Java 2 Essentials,** 3rd edition
  Cay Horstmann and Janice Pratt Van Cleave
  ISBN: 047124371X
- **Java 2, the Complete Reference**
  Herbert Schildt
  ISBN: 0-07-222420-7

Code	Nr	Course Title	L	E	P	CP
ENGD	301	Engineering Drawing and Design	1	2	0	3

Prerequisite Courses
None

Course Outline
Engineering drawing is the language if the industry. Graphic representation deals with concepts by way of lines or marks impressed on a surface. A drawing is the graphic representation of a piece of imagination or reality. Engineering drawing as a graphic language expresses ideas of technical nature with a pragmatic intention. It is the tool kit used in all branches of industry. The Engineering design process includes the way from the first idea and intuitive concepts to the final development and evaluation of the quality of a product.

Course Outcome

Students will confidently use lines and letters in a technical drawing. They will be able to distinguish between the different types of projections, indicate the dimensions and tolerance of technical products, read print, and change drawings according to specific requirements. They will get a basic idea about how to produce a computer aided drawing (CAD).

The learning objectives are divided into 5 learning units:

- Basic Drawing and Design
- Technical Drawing
- Machine Elements and Devices
- Working Drawings and Design
- CAD Systems

References and Textbooks

- C. H. Jensen and J. D. Heisel: **Fundamentals of Engineering Drawing**, 4th edition, MacGraw-Hill, 1990
- B. A. Wilson : **Design Dimensioning and Tolerancing**, 3rd edition, The Goodheart-Willcox Co., 2001

3rd Semester

Code	Nr	Course Title	L	E	P	CP
MATH	301	Mathematics III	4	4	0	8

Prerequisite Courses
Math 103, Math 203

Course Outline

The course continues with vector calculus which introduces a calculus in several variables. Differentiation of functions in more than one variable is examined and the extremal values of these functions are discussed. Specifically this course covers operations like gradients, divergents, curls of scalar and vector fields. In addition important integral theorems like Green's, Stoke's and Gauss's theorem are introduced and the application to scalar and vector fields is discussed. For functions in more than one variable differential equations (partial differential equations PDE) like the diffusion and wave equation are derived and the solution strategies for linear PDEs is discussed as an initial and boundary value problem. The solutions are derived by using Laplace and Fourier Transforms and the related Series. In addition Green's solution procedure is used to solve linear PDEs.

Course Outcome

Students should be able to apply the concepts of vector calculus to scalar and vector fields. They should be able to understand the properties of scalar and vector functions in higher dimensions and with components greater then three. In addition student should be able to classify partial differential equations and derive solutions for a linear initial boundary value problem.

Content

- Vector Calculus
- Integral Theorems
- Integral Transforms
- Fourier Series
- Partial Differential Equations

Textbooks

- J. Stewart, **Calculus,** Books/Cole-Thomson Learning, Belmont, 2003

Reference books

- **Advanced Engineering Mathematics**, 8th edition, by E. Kreyszig, J. Wiley & Sons, 1999
- **Shaum's Outline of Advanced Mathematics for Engineers and Scientists**, 1st edition, by M.R. Spiegel, McGraw-Hill, 1971

Code	Nr	Course Title	L	E	P	CP
PHYSt	301	Physics III (T)	3	2	0	5

Prerequisites
PHYS 101, PHYS 202

Course Outline
This course is the final course in introductory physics. It covers Thermodynamics, Waves and Optics. The course will deepen the existing knowledge in all the fields in two directions. One is the understanding of the fundamental models in the fields mentioned above and the physicists' way to describe and analyze the world. The second one is to show where and how the fundamental discoveries are present in the world around us, either natural or in man-made forms.
In addition the course includes a lab part consisting of introductory experiments from Mechanics, Thermodynamics, Electricity, Sound and Optics.

The major conceptual topics of the course will be:
Thermodynamics: Temperature and temperature scales, thermal expansion of solids and liquids, specific heat, latent heat, First law of TD, Kinetic Gas Theory, heat engines, Second law of TD, Heat pumps and refrigerators, Carnot Engine, combustion engines
Waves: Wave motion, speed of waves, linear wave equation, Sound waves, Doppler effect, superposition, interference, standing waves, resonances, beats
Optics: Geometrical Optics, Imaging with lenses and mirrors, optical instruments, Interference, Diffraction, Resolution, Polarization

Course Outcome

In the course students will acquire comprehensive knowledge of the fundamental physical principles in the fields covered in the course as well as their mathematical description. They will learn how to apply these principles to the analysis of simple problem settings and how to use the formulas for the solution of the problems.

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

1. Describe the basic concepts, laws and models in the fields of the course, and have a sound knowledge about the limitations of these concepts,
2. Describe relevant physical quantities and distinguish between related quantities,
3. Identify the underlying concepts in text-book and simple real-world situations,
4. Use these principles to analyze such situations, including situations which students did not encounter before,
5. Convert text, graphic and numerical representations for a given physical problem,
6. Apply mathematics in order to simplify, quantify and apply the physical principles,
7. Estimate a physical quantity or numerical result to check its plausibility.

Code	Nr	Course Title	L	E	P	CP
PHYSp	301	Physics III (P)	0	2	0	2

Upon completion of the Lab part of the course, the students should have gained the following knowledge and skills:

- Manipulate common laboratory apparatus and make measurements, including calibration, zero-checking, and troubleshooting.
- Explain the physical principles by which the apparatus operates, and the relation to the measurement to be made.
- Correctly use the concepts of random and systematic error and propagation of error, and manipulate statistical quantities to determine the uncertainty in a measurement.
- Evaluate whether or not an experimental result agrees with a theoretical prediction using the experimental uncertainty associated with the measured values.
- Use computational tools (e.g. spreadsheets, graphing software) to manipulate and process data, including curve-fitting.

References and Textbooks

- **Serway and Jewett: Physics for Scientists and Engineers**, with Modern Physics. Thomson Brooks/Cole (mandatory)

Code	Nr	Course Title	L	E	P	CP
ELCT	201	Digital Logic Design	2	2	0	4

Prerequisite Courses
CSEN 102

Course Outline
The course is designed to provide freshman students in all engineering majors an introduction to the basic components of digital systems and an introduction to digital hardware design at the gate level. The main emphasis is on developing an in-depth knowledge of digital logic design to enable students to design small digital systems for different applications.

Course Outcome
The course will help students design, implement, connect and simulate digital logic circuits and test their outputs. Students will also be equipped with different approaches that will enable to analyze, optimize and simplify digital systems, such as Karnaugh maps.

By the end of the course, the student will be able to:

- Understand different numerical codes and how to transform to or from the Binary numeral system.
- Understand Boolean algebra and its relevance to digital logic design
- Describe the basic logic functions and gates (AND, OR, NOT, NAND, NOR, XOR)
- Understand combinational logic components—such as adders, decoders, encoders, multiplexers, etc.
- Analyze and design combinational and sequential circuits
- Design larger components from compositions of smaller one

References and Textbooks
- **Digital Design,** 3rd Edition, M. Morris Mano, Prentice-Hall, 2002, ISBN 0-13-062121-8

Code	Nr	Course Title	L	E	P	CP
ELCT	301	Electric Circuits I	2	2	2	6

Prerequisite Courses
Physics 102, Physics 202

Course Outline
Electric circuits represent the foundation of electrical engineering studies and practices. All electrical systems can be modeled using the electric circuits approach. Therefore, learning how to build and analyze electric circuits constitute a milestone in building engineering career. This course will provide the students with strong understanding of electric circuits with emphasis on the techniques for analysing electric circuits in steady state and in transient state as well.

Course Outcome
The main objectives of this course are:

- To build an understanding of the basic concepts of electric circuits.
- To apply the basic laws of electric circuits.
- To learn the different analysis methods of electric circuits.
- To analyze different configurations of resistive circuits using these methods.
- To investigate the transient phenomena in electric circuits.
- To develop the students' problem solving skills.

References and Textbooks

- J. W. Nilsson and S. A. Riedel, **Electric Circuits**, Seventh Edition. Upper Saddle River, NJ: Prentice Hall, 2005.

Code	Nr	Course Title	L	E	P	CP
CPS	402	Communication & Presentation Skills	0	2	0	1.5

Prerequisite Courses
Completion of the courses Academic Study Skills (AS) and Critical Thinking & Scientific Methodology (SM)

Course Outline
Communication and Presentation Skills is a course which introduces students to various types of oral communication. It aims at equipping students with the basic skills needed for college presentations as well as for career presentations. It fosters team-work spirit in problem solving in the students while trying to teach them to become effective team leaders and active team members during group discussions. It also prepares the students to handle working in multicultural firms with maximum efficiency and minimum miscommunication.

Course Outcome
Upon completing this course, the students should be able to:

1. Deliver short presentations
2. Take an active role in a group formed to solve a problem:

2. a. effectively use the steps for active problem solving
2. b. effectively use the steps for being an active group leader
2. c. effectively use the steps for being a responsible group member
2. d. avoid miscommunication
2. e. clarify their intentions
2. f. use interpersonal communication styles
2. g. use direct and indirect communication styles
2. h. understand nonverbal communication
2. i. understand cultural differences in communication

Learning Outcomes:
V. Given a 10 minute presentation or a 10 minute excerpt from a longer presentation, students will be able to:
a. recognize the type of speaking
b. analyze its structure
c. evaluate the appropriateness of the presentation for the intended audience
d. evaluate the scope of the topic
e. evaluate the clarity of the purpose
f. evaluate the appropriateness of the presented information to the selected topic
g. evaluate the adequacy of the support used
h. evaluate the use of visuals
i. evaluate the use of body language
j. evaluate the use of stress, intonation, voice level, and pacing
k. evaluate time management efficiency
with an accuracy level of 100 %.

VI. Given an academic or a career related topic, students will be able to prepare a 15 minute presentation by:
a. narrowing down the topic
b. identifying the intended audience
c. defining the purpose
d. using the appropriate speaking strategies to inform
e. using the appropriate speaking strategies to persuade
f. finding an adequate amount of information

g. using adequate support
h. organizing the speech (introduction, body, conclusion)
i. outlining the speech
j. choosing appropriate visuals
k. designing effective visuals
l. choosing the appropriate style
m. budgeting time effectively
with an accuracy level of 95%

VII. Given an academic or a career related topic, students will be able to deliver a 15 minute presentation by:
a. facing the audience with no apparent nervousness
b. presenting the information effectively
c. presenting the support effectively
d. presenting the visuals skillfully
e. using appropriate stress, tone, voice level, and pacing
f. using the appropriate body language
g. speaking clearly
h. maintaining the audience interest
i. demonstrating time management efficiency
with an accuracy level of 90 %

VIII. Given a problem for group discussion, given a role in a team, and given 20 minutes, the students will be able to:
a. effectively use the steps for active problem solving
b. effectively use the steps for being an active group leader
c. effectively use the steps for being a responsible group member
d. avoid miscommunication
e. clarify their intentions
f. use interpersonal communication styles
g. use direct and indirect communication styles
h. demonstrate awareness of nonverbal gestures
i. demonstrate awareness of cultural differences
with an accuracy level of 90%

V. Evaluation:

- Mini-group presentations (3 presentations) 30%
- Mid-term (theoretical applications: MCQ, CDs/tapes) 20%
- Problem solving group discussion 20%
- Final peer reviewed presentation 30%

References and Textbooks

• Gregory, H. (2005). Public speaking for college and career with speech mate 3.0, 7th edition. McGraw Hill, Higher Education: USA.
• Dale, P. & Wolf, J. (2000). Speech communication made simple: A multicultural perspective. Longman: NY, USA.

Code	Nr	Course Title	L	E	P	CP
HUMA	301	German Language III	0	4	0	3

Prerequisites
German Language I and II

Course Outline
The course offers basic German to beginners with some previous knowledge

Grammar:
- use the past tense (see the perfect list on the intranet: - use all personal pronouns (ich,du, er, sie, es, wir, ihr, sie, Sie) in the nominative, accusative and dative form
- understand and reply to negative questions,
- understand and use dative pronouns
- understand and use all possessive articles (mein, dein, sein, ihr, unser, euer, ihr, Ihr) in the nominative and accusative case

Topics:
- Travel
- Living, living spaces
- Restaurant, going out

Reading:
- understand simple information from a diary
- understand a simple text about houses and living
- understand a menu

Writing:
- tell about a trip in the past
- describe a picture
- write a postcard

Listening:
- perform listening comprehension tasks

Course Outcome
By the end of this course, the student can
- understand public announcements
- write a paragraph in the past tense
- talk about everyday occurrences in the past
- understand discussions about living situations
- name the different colours
- understand conversations at parties
- talk about eating habits
- perform reading and listening tasks
- write different types of texts (e-mail, letter, postcards, dialogues, descriptions) of about 60 words

References and Textbooks

- Optimal A 1, Chapter 7 – 9 & supplementary material and vocabulary lists on the intranet

Code	Nr	Course Title	L	E	P	CP
CSEN	301	Data Structures and Algorithms	2	2	2	6

Prerequisite Courses
CSEN 202

Course Outline

The course is intended for students who have a working knowledge of the core Java programming language; this course introduces classical data structures and algorithms in a programming perspective. Students will learn about tools and strategies that have proven themselves useful in modeling real-world problems and solving problems on a computer.

Course Outcome

Students will learn the following topics

- Complexity analysis and sorting algorithms
- Set representations
- Linked lists, stacks and queues
- Trees, hash tables and hash functions

References and Textbooks

- **Data Structures and Algorithms in Java** Robert Lafore
  ISBN: 0672324539

4th Semester

Code	Nr	Course Title	L	E	P	CP
MATH	401	Math IV Probability and Statistics	2	2	0	4

Prerequisite Courses
Math 103, Math 203, Math 301

Course Outline
The course is designed to introduce engineering students to the fundamental concepts and techniques of Probability Theory and Statistics.
This course starts with introducing the concepts of descriptive and inferential statistics, and then, of a sample and a population. Studying the techniques of descriptive statistics we arrive at a necessity to develop our machinery to be able to move to the inferential statistics. To develop the required apparatus we introduce the fundamental notions of probability theory: sample spaces and events, probability, conditional probability and independent events, as well as some important methods to compute probabilities. We proceed then with a general discussion of discrete and continuous random variables and their main characteristics: the expectation and the variance. Special probability distributions, most important for applications, are then studied in detail: Bernoulli and polynomial random variables, Poisson random variables as well as uniformly, normally, exponentially and Gamma distributed random variables.
The main tool of statistical analysis – The Central Limit Theorem – is then discussed and applied to the first problem of inferential statistics: point and interval estimation of parameters. We discuss then hypothesis testing, significance levels and tests concerning the mean of a normal population, and regression problems. Regression problems are restricted to least squares estimators and their distribution, inferences about regression parameters. We complete the course with some quality control problems.

Course Outcome
- Descriptive and Inferential Statistics. Samples and Populations
- Describing and Summarizing Data Sets. Chebyshev's Inequality
- Sample Spaces and Algebra of Events. Axioms of Probability
- Conditional Probability and Independent Events. Bayes' Formula
- Random Variables (Bernoulli, Polynomial, Poisson, uniform, normal, exponential, Gamma)
- Central Limit Theorem. Sample Mean and Variance
- Point and Interval Estimation of Parameters. Confidence Intervals
- Basic notions of statistics, frequency distributions
- Hypothesis Testing: Significance Levels, Tests for Normal Mean
- Least Squares Estimators for Regression Parameters (RP). Inferences about RP.
- Control Charts for Average Values (provided the time permits)

References and Textbooks

- S. M. Ross, **Probability and Statistics for Engineers and Scientists,** Academic Press, Amsterdam, 2004
- Douglas C. Montgomery, George C. Runger: **Applied Statistics and Probability for Engineers,** Wiley, Hoboken, 2006

Code	Nr	Course Title	L	E	P	CP
CSEN	403	Concepts of Programming languages	2	2	0	4

Prerequisite Courses
CSEN 202, CSEN 301

Course Outline
This course focuses on several programming paradigms. Lectures discuss commonalities and differences among the different languages, their syntax, their semantics, their type systems, their implementation methods as well as the features provided in their development environments. In this course, the following programming paradigms are introduced:

- Logic Programming: Prolog
- Functional programming: Haskell
- Procedural programming: C
- Object-Oriented programming: Java

For each of the above paradigms, the course will cover the following aspects:
- Names, variables, ADTs and data structures
- Parameter-passing mechanisms
- Typing: static and dynamic typing; weak and strong typing
- Polymorphism and genericity
- Memory management
- Exception handling techniques

Course Outcome

Throughout this course, students will learn about a variety of different programming languages and their relative strengths and weaknesses. They will gain experience designing and writing programs in a selected set of languages using their ability to distinguish between the different paradigms reaching finally an efficient implementation.

References and Textbooks
- **Programming Language Concepts and Paradigms** by David A. Watt (Prentice-Hall, 1990).
- **Programming Languages: Principles and Paradigms**, 1st Edition, by Allen Tucker and Robert Noonan (McGraw-Hill, 2002).

The particular texts and papers chosen depends on particular paradigms/languages covered. Some representative texts are:

W. Clocksin and C. Mellish, *Programming in Prolog*, Springer-Verlag, 1987.

Code	Nr	Course Title	L	E	P	CP
CSIS	402	Computer Organization and System Programming	2	2	0	4

Prerequisite Courses
CSEN 102, CSEN 202

Course Outline
This course studies the fundamental principles of computer systems in order to be able to better understand hardware and software and the relation between them. It covers the basic components of computing systems, common to most computing architecture, and their interrelationship structure, with emphasis on the intermediate assembly language level. It is composed mainly of two parts: computer organization and systems programming. The computer organization part provides details on the actual construction of computer hardware systems (processor design: data path and control, memory: cache memory and virtual memory) while the systems programming part includes the Instruction set architecture and the assembly programming language that is specific to a given architecture. This course offers the foundation for other courses like Computer Architecture, Operating Systems and Compilers.

Course Outcome

Upon the completion of this course, students will no longer consider the computer as a black box. Instead, they will understand the role played by each major component of the computer system, how software is run on a processor and how to write an efficient program in assembly language.
Upon completion, students will be able to:

- Identify the components of an instruction set and its format
- Design programs in assembly code for a specific processor (RISC)
- Analyze the fetch-decode-execute cycle
- Implement a 32 bit multiplication, division
- Design a simple 32 bit ALU
- Construct a simple data path
- Analyze and compare the performance of computer systems

References and Textbooks

- **Computer Organization and design**
  Patterson and Hennessy, 3rd edition, 2004

Code	Nr	Course Title	L	E	P	CP
CSEN	401	Computer Programming Lab	2	0	2	4

Prerequisite Courses
CSEN102, CSEN202, CSEN301

Course Outline

The Computer Programming Lab is about:

- Working within a team
- Learning the basics of Object-Oriented software development
- Establishing a deeper understanding of the Java programming language
- Planning and implementing a software project in a small team

Contrary to the previous courses students have encountered, the Computer Programming Lab is a course that leaves it up to the students to identify and obtain the required knowledge to complete the course tasks.

Course Outcome

Upon the completion of the course, the students will master concepts such as inheritance and polymorphism and their importance in software development. The students will develop network-enabled application with a Graphical User Interface (GUI).

Topics covered in the course

- Creating GUI-based Applications
- Graphics
- Network Programming
- Multi-threading

References and Textbooks

- **Computing Concepts with Java 2 Essentials, 3rd edition**
  Cay Horstmann and Janice Pratt Van Cleave
  ISBN: 047124371X
- **Java 2, the Complete Reference**
  Herbert Schildt
  ISBN: 0-07-222420-7

Code	Nr	Course Title	L	E	P	CP
ELCT	401	Electric Circuits II	2	2	2	6

Prerequisite Courses
Physics 102, 202, 301
ELCT 301

Course Outline
The course constitutes an important building block for all electrical engineers and it is the logic continuation of Electric Circuit I. The course starts with the application of the tools gained in Electric Circuits I to investigate the performance of electric circuits comprising operational amplifiers. The course then moves to cover the techniques employed to analyze electric circuit supplied from sinusoidal source(s). These techniques are then applied to calculate the electric power in both single phase and three phase circuits. Finally, Laplace's Transform is introduced in this course as a general approach to analyze electric circuits in both time domain and frequency domain and applications of this transform are also

Course Outcome
Upon successful completion of this course, the student should be able to:

- Calculate the output of electric circuits containing ideal operational amplifiers.
- Apply frequency domain analysis technique to solve Alternating Current (A.C.) circuits.
- Calculate the complex power, the active power, the reactive power and the power factor for single phase circuits.
- Write the equations that govern the operation of three-phase balanced circuits.
- Apply the Laplace Transform to identify the features of frequency selective circuits.

Course Content
- The Operational Amplifiers [2 lectures]
- Sinusoidal Steady State analysis (A.C. analysis) [3 lectures]
- Power Calculations in A.C. Circuits [1&1/2 lectures]
- Balanced three-phase circuits. [2&1/2 lectures]
- Frequency Selective Circuits [2 lectures]

References and Textbooks
- James W. Nilsson and Susan A. Riedel, **"Electric Circuits** 7th (or 6th) Edition", Prentice Hall, 2005
- Charles K. Alexander, Matthew N.O. Sadiku, **"Fundamentals of Electric Circuits**, 2/e," McGraw Hill, 2004.

Code	Nr	Course Title	L	E	P	CP
COMM	401	Signal and System Theory	2	2	2	6

Prerequisite Courses
Math 103, MATH203, MATH301, ELCT 301, ELCT 401

Course Outline
This course:
- lay foundations for all engineering disciplines
- abstracts from physical signals and systems
- learn powerful, generic tools for elegant and unified treatment of multifaceted engineering problems

Course Outcome
Upon completing the course, the student shall be able to do each of the following
- use the Fourier transform/series for analysis of continuous and discrete time signals
- know and understand the properties of linear time-invariant systems defined by impulse response
- deal with continuous-time and discrete-time concepts

Course Content

1. Signals and Systems
2. Linear Time–Invariant Systems
3. Fourier Series Representation of Periodic Signals
4. The Continuous–Time Fourier Transform
5. The Discrete–Time Fourier Transform
6. Sampling and Reconstruction
7. Communication Systems

References and Textbooks

- v. Oppenheim, A. S. Willsky, H. Nawab (1996). **Signals and systems**, Prentice-Hall Inc., ISBN 0138147574.

Code	Nr	Course Title	L	E	P	CP
HUMA	402	German Language IV	0	4	0	3

Prerequisites
German Language I to III

Course Outline
The course offers basic German to beginners with basic previous knowledge

Grammar:

- simple past of the modal verbs: wollen–müssen -dürfen–können -sollen
- conjunctions: wenn, weil, dass
- sub-clauses with present perfect, modal verbs, seperable verbs.
- reflexive verbs and reflexive pronouns
- the two-way prepositions:

an, auf, hinter, in, neben, über, unter, vor, zwischen
accordingly the dynamic and static verbs: liegen, legen,
stehen, stellen, hängen, hängen, setzen, sitzen.

- adjective endings in nominative and accusative:

with definite and indefinite articles with all nouns gender (masculine,
feminin, neutral & plural nouns)

- the interrogative pronoun 'welch-' (which) in nominative and accusative: welcher, welches, welche(f), welche(pl) und welchen
- prepositions with accusative: für, durch, gegen, ohne, um
- in addition to the previous grammar topics of DE101-DE303 (please refer to the course outlines of DE 101-DE 303)

Topics:

- health and personal well being
- clothes, fashion and shopping
- in addition to the previous DE101-DE404 topics

Vocabulary: Vocabulary lists from chapter 1-11
(active vocab.: bold-faced words; passive vocab. : normal typed words)

Course Outcome
By the end of this course, the student can:

- write a text about his/her health condition and personal well being (e.g. sickness, pain and injuries)
- obtain and deliver information about a doctor's visit
- understand pamphlets/instructions of medicaments
- write a text describing person's looking and outfit
- write a dialogue or text about shopping
- express his/her attitude towards fashion
- perform listening and comprehension tasks
- write different types of texts (e-mail, letter, postcards, dialogues, descriptions) using present and past tense.

References and Textbooks

- Optimal A 1, Chapter 10, 11
- Supplementary material and vocabulary lists on the intranet under the following link: V:\Faculties\Language Centre\German\DE 404

Code	Nr	Course Title	L	E	P	CP
RPW	401	Research Paper Writing	0	2	0	1.5

Prerequisites:
Completion of the courses Academic Study Skills (AS), and Critical Thinking and Scientific Methods (SM)

Course Outline
This course introduces the principles of scientific research. Students learn how to conduct manual and computerized library searches in order to locate relevant, reliable and recent sources. They read, analyze and critique scientific research studies based on the research questions asked and the methodology used. An important component of the course is to write a literature review. Students learn to gather data about a given topic, and then synthesize it in a paper which would show their understanding of what has been discovered as well as their identification of controversial areas which need to be further explored.

Learning outcomes
I. Given a scientific study, students will be able to:
a. Identify the problem with an accuracy level of 100%
b. Identify the hypothesis and/or the research question with an accuracy level or 100%
c. Identify the experiment's design with an accuracy level of 100%
d. Evaluate the data collection method with an accuracy level of 85%
e. Evaluate the data analysis with an accuracy level of 85%
f. Evaluate the findings' interpretations with an accuracy level of 85%

II. Given an area of interest, students will be able to:
a. Narrow down the topic with an accuracy level of 90%
b. Formulate a research question with an accuracy level of 90%
c. Identify relevant sources for the research using both the library and the internet with an accuracy level of 90%
d. Evaluate the relevant sources with an accuracy level of 85%
e. Cite sources using an appropriate academic format with an accuracy level of 100%
f. Record the relevant information using different types of note cards with an accuracy level of 80%
g. Synthesize the information from the various sources with an accuracy level of 80%
h. Organize the information in outline form with an accuracy level of 85%
i. Write a literature review with an accuracy level of 80%

Course Outcome

By the end of the course students will be able to:
1. Conduct effective library research.
2. Identify types of scientific research and methodologies used.
3. Identify concepts and terms of scientific research.
4. Analyze scientific research critically on the basis of the strength or weakness of the methodology used (sampling, data gathering tools, interpreting the findings).
5. Document sources.
6. Develop critical thinking skills that can be used to help interpret and evaluate information.
7. Write a literature review in which sources are synthesized in order to shed light on a given topic and identify areas of further study.

References and Textbooks

• Perry, F.L. (2005).Research in applied linguistics: Becoming a discerning consumer. NJ: Lawrence Erlbaum Associates.

5th Semester

Code	Nr	Course Title	L	E	P	CP
MATH	501	Mathematics V (Discrete Math)	2	2	0	4

Prerequisite Courses
Math 103, Math 203, Math 301

Course Outline
The course is designed to introduce students to the fundamental concepts of discrete mathematics. The discrete part is related to the validation of computer programs and major applications in computer science.

It starts with the motivation of discrete mathematics and introduces the student to propositional logic and discusses the logical value of an expression. Using propositional logic a formal proof method is constructed. These can be used to determine the validity of an statement given in English or to proof that an algorithm in computer science is correct. The next step is to introduce formal symbols and predict their logic value. Predicate logic is used to determine the truth table of several mathematical expressions as well as expressions of our used language. Predicate logic is also used to check the correctness of programs that use assignment and conditional statements. A major point in this proof technique part is to discuss the different types of proofs like direct, contraposition, contradiction and induction proofs. After completing the proof's section sets and set operations are introduced. The previous proof techniques are used to show that certain set identities are correct and useful in computer science applications. The reflexive, symmetric, transitive, and antisymmetric properties of binary relations are discussed and consequences are derived from the proofs for mappings and functions and their graphs. The terminology of graphs, direct graphs and trees is introduced to describe simple, connected planar graphs by Euler's formula and prove elementary properties of them. Different algorithms like Dijkstra's and Prim's are applied to to simple connected graphs.

Course Outcome
Students should be able to apply the basic concepts of discrete mathematics to computer science applications. At the end of the course, they should know the following subjects:

- Use propositional and predicate logic
- Use the different proof techniques
- Have basic knowledge on sets
- Use set theory in computer applications
- Understand the different types of binary relations
- Use graphs and trees to formulate and solve problems in computer science

Textbooks
- J.L. Gersting, Mathematical Structures for Computer Science-A Modern Treatment of Discrete Mathematics, W.H. Freeman and Company, 2003

Reference Books
- J.A. Anderson, Discrete Mathematics with Combinatorics, Pearson Prentice Hall, Upper Saddle River, 2004

Code	Nr	Course Title	L	E	P	CP
DMET	501	Introduction to Media Engineering	2	2	0	4

Prerequisite Courses
None

Course Outline

The course is designed to provide students an introduction to the principles and practice of Multimedia Systems. The term multimedia generally means using some combination of text, graphics, animation, video, music, voice, and sound effects to communicate. In order to achieve a complete and balanced view on multimedia engineering field, this course is organized into three broad parts: multimedia presentation and authoring, multimedia data compression and multimedia communication and retrieval. The first part discusses the most important data representations for multimedia applications, addressing digital image, computer graphics, video, animation and digital audio. It also highlights the most commonly used authoring metaphors and tools. The second part introduces different multimedia data compression algorithms, examining their roles in making modern multimedia systems possible. The third part presents the network technologies and protocols that make interactive multimedia. This part gives the students the basics of telecommunication, network requirements, quality of services and content-based retrieval.

Course Outcome

- Introduction to digital media
- Fundamentals of multimedia data representation and processing
- Introduction to sampling theory, formats and standards
- Introduction to multimedia authoring metaphors and tools
- Color spaces
- Principles of multimedia data compression
- Basics of telecommunication, network requirements, quality of services
- Multimedia Retrieval

References and Textbooks

- Ze-Nian Li and Mark S. Drew. **Fundamentals of Multimedia**. ISBN: 0130618721, Prentice-Hall, 2004.
- N. Chapman and J. Chapman. **Digital Multimedia**. ISBN: 0-470-85890-7, John Wiles, 2004.
- R. Steinmetz and K. Nahrstedt. **Multimedia: Computing, Communications and Applications**. Prentice Hall, 1995.

Code	Nr	Course Title	L	E	P	CP
CSEN	501	Data Bases I	2	2	2	6

Prerequisite Courses
CSEN102, CSEN202, CSEN301

Course Outline
In this course, the students will learn the basic theories of database systems as well as basic skills to operate a database so that they can design, implement, and operate an application database. The major topics covered in this course include high-level conceptual database design using ER and EER models; relational database concepts, relational database design by ER- and EER-to-Relational mapping, and basic SQL programming.

From a course project running through the entire semester, the students will learn to design simple database applications using ER model, implement them on a relational database management system, and write queries to extract information from the database.

Course Outcome
Learning state-of-the-art database concepts, theories, techniques, and tools that are directly applicable to a Computer Engineering career, including:

- Database system concepts and system architecture.
- Relational database design, modeling and implementation.
- Relational database query (SQL) and Object-Relational extensions

To strengthen professional communication and collaboration skills:

- Learning to actively participate in class discussion and lab sessions in a professional manner.
- Practice public presentation skills by presenting ideas and project results.
- Working in groups to practice project planning, leadership and interpersonal communication skills.

Topics covered in the course:

- Basic Concepts of Database Systems
- The Entity Relationship Diagram
- Relational Algebra
- Database Design & Normalization
- Structured Query Language (SQL)
- Storing Data and File Organization

References and Textbooks

- **Fundamentals of Database Systems,** 4th edition ,Ramez Elmasri and Shamkant B. Navathe..ISBN 0-321-12226-7

Code	Nr	Course Title	L	E	P	CP
CSEN	503	Introduction to Communication Networks	2	2	0	4

Prerequisite Courses
None

Course Outline

This is an introductory course to the basic concepts in computer communication networks. The Internet, which is an important part of the communication infrastructure, is considered throughout the course as a case study. The course introduces the students to the architecture, protocols and applications of computer networks. Topics covered follow a top-down approach starting from the application layer up to the physical layer, going through transport, sockets interface, congestion control, routing, addressing, and data link layer. Some advanced topics will also be discussed such as mobile-IP and multimedia networking.

This course provides the basis needed to understand how networks and Internet work. Also, it is a prerequisite for the network and media lab.

Course Outcome

The main goal of this course is to give the students a solid grounding in the central concepts of communication networks. Students will be able to understand fundamental issues covering network architectures, protocols, interfaces and applications.

Topics covered in the course

- Protocol Layering
- Application Layer: Http, SMTP, FTP, DNS
- Transport Layer: UDP, TCP
- Network Layer: Routing, IP, Multicast Routing
- Advanced Topic: Mobile-IP
- Data Link Layer
- Multimedia and Quality of Service

References and Textbooks

- **Computer Networking, A Top-Down Approach Featuring the Internet,** 3rd edition
  James F. Kurose & Keith W. Ross
  ISBN 0-321-26976-4

Code	Nr	Course Title	L	E	P	CP
CSEN	502	Theory of Computation	4	2	0	6

Prerequisite Courses
CSEN 301

Course Outline
The theory of computation comprises the mathematical underpinnings of computer science. It introduces three major topics: formal languages and automata theory, computability theory, and complexity theory. This course focuses on the first two, and provides an introduction to the third.
Complexity theory classifies problems with respect to their intrinsic degree of hardness, or the amount of computational resources (in terms of space and time) required to solve them. Computability theory addresses a more fundamental issue: is a given problem solvable (by a computer) in the first place? The theory of formal languages and automata investigates mathematical models of computation, and classifies them with respect to their computational power. These models are used to answer questions and prove results in both computability and complexity theory.
In addition to its foundational role, the theory of computation had had vast applications in various areas of computing. These include the specification of the syntax of programming languages, compiler construction, string processing, and cryptography.

Course Outcome
By the end of this course, students will develop the rigor and skills required to precisely present and prove various properties of computations. Students will be able to precisely state and prove properties of various formal languages and models of computation. They will also be capable of giving sound arguments for why a given problem is, or is not, (computationally) solvable. If a problem is solvable, students will be able to precisely establish whether possible solutions are feasible.
They should be able to do the following:

- Determine the membership of a given string in an intentionally defined formal language
- Prove properties of an intentionally defined formal language
- Precisely describe the language of a given finite automaton
- Design finite automata to recognize a given regular language
- Transform a nondeterministic FA into a deterministic FA
- Describe regular languages using regular expressions
- Transform a regular expression into the equivalent FA
- Transform a FA into the equivalent regular expression
- Prove properties of regular languages
- Determine whether a given language is not regular, using the pumping lemma for regular languages
- Precisely describe the language generated by a given context-free grammar
- Design CFGs to generate a given context-free language
- Transform a CFG into a CFG in Chomsky normal form
- Precisely describe the language of a given pushdown automaton
- Design a PDA to recognize a given CFL
- Transform a CFG into the equivalent PDA
- Transform a PDA into the equivalent CFG
- Prove properties of CFLs
- Determine whether a given language is not context-free, using the pumping lemma for CFLs
- Design Turing machines to decide, compute, or enumerate given languages

- Prove whether a given language is undecidable
- Prove whether a given language is Turing-unrecognizable
- Describe the behavior of functions using the O and o notation
- Determine the time complexity of a Turing machine program
- Prove that a given language is in P
- Prove that a given language is in NP
- Prove that a given language is NP-complete

References and Textbooks

- Sipser, Michael (2006). **Introduction to the Theory of Computation** (2nd edition) , Thomson Course Technology.

Supplementary material: Excerpts to be provided in class.

Other reference material:

- Hopcroft, J., R. Motwani, and J. Ullman, **Introduction to Automata Theory, Languages, and Computation** (2nd edition), Addison Wesley, 2001.
- Martin, John, **Introduction to Languages and the Theory of Computation**, McGraw 2003

Code	Nr	Course Title	L	E	P	CP
CSEN	605	Digital System Design	2	2	0	4

Prerequisite Courses
ELCT 201

Course Outline
The aim of this course is two-folds:

- to enhance the students' knowledge of digital analysis and design by introducing them to techniques to analyze and design advanced combinational and sequential circuits,
- to introduce them to Hardware Description Languages (HDL) and modeling circuits with Verilog HDL.

Topics covered in the course

- Analysis and Design of Advanced Combinational and Sequential Circuits
- Analysis and Design of Arithmetic Circuits
- Modern CAD Tools Usage, and Hardware Description Languages (Verilog HDL)
- Miscellaneous Concepts about Digital Design

References and Textbooks

- **Digital Design, 3rd edition**
  M. Morris Mano
  ISBN: 0130621218

6th Semester

Code	Nr	Course Title	L	E	P	CP
CSEN	601	Computer System Architecture	2	2	2	6

Prerequisite Courses
CSEN102, CSEN 201, CSIS 402

Course Outline
This course is designed for Computer Engineering students to provide them with the appropriate background to work with hardware. The course focuses on the core concepts in the engineering design aspects of computer architecture.

Course Outcome
Upon completing this course, the students will be able to:

- Identify the fundamental of computer systems design the components of an instruction set and its format
- Apply various design techniques, such as pipelining, instruction level parallelism, and multithreaded/multiprocessors systems.
- Identify and compare between the numerous techniques in memory (cache) design including the implementation, management and interconnection to the rest of computer systems
- Identify basic principles in the I/O systems
- Discuss issues related to the shared memory multiprocessors,

References and Textbooks

- **Computer Architecture: A Quantitative Approach**
  Patterson and Hennessy

Code	Nr	Course Title	L	E	P	CP
CSEN	602	Operating Systems	2	2	0	4

Prerequisite Courses
CSEN102, CSEN202, CSEN301, CSIS402

Course Outline

The course is an introduction to the fundamental concepts of operating systems. These include some basic concepts such as the nature of operating systems, their history, and their function within an overall computer system. In addition, many of the more involved issues in operating system design are discussed. This includes process scheduling, synchronization, deadlocks, memory management, file management, and input/output operations.

Course Outcome

By the end of this course, students will have an overall picture of how an operating system operates. They will gain a deep understanding of the problems and issues an operating system designer inevitably faces, together with proposed solutions and treatments of those problems.

After passing this course, students should be able to do the following:

- Define and list the functions of an operating system
- Differentiate between program, process and thread
- Identify and analyze the problems related to scheduling, synchronization and deadlocks
- Recognize how files are managed by an operating system
- Explain the function and structure of I/O systems

Course Contents

- Computer and operating systems structures
- Process and thread management
- Scheduling policies
- Concurrent processes and Synchronization
- Deadlocks (prevention, avoidance and detection)
- Memory management and virtual memory
- File systems
- I/O management

References and Textbooks

- Andrew S. Tanenbaum (2001). **Modern Operating Systems** (2nd edition). Prentice Hall. ISBN: 0-13-092641-8

Code	Nr	Course Title	L	E	P	CP
MNGT	601	Introduction to Management	2	0	0	2

Prerequisites:
None

Course Outline
The course is designed to provide engineering students with the basic concepts and analytical tools to understand the principles of management. In particular they will hear about:

- The challenges a firm has to meet in a global business environment
- Production, logistics, operations management, and investments
- The risks and the benefits of export orientation
- Innovation and technology management
- Budgeting

Course Outcome
The students should be able to:

- Handle the basic management techniques
- Use management terminology in the appropriate way
- Communicate with people from finance, marketing and strategic management without stress
- See the professional tasks in the global market context

Code	Nr	Course Title	L	E	P	CP
CSEN	603	Software Engineering	2	0	2	4

Prerequisite Courses
CSEN202, CSEN301, CSEN401

Course Outline

The course is an introduction to the discipline of Software Engineering. Students will explore the major phases of the Software Lifecycle, including analysis, specification, design, implementation, and testing. Techniques for creating documentation and using software development tools will be presented. Students will develop a software system, working in a team.

Students will gain experience in software project management, requirements, analysis, and design, procedural maturity, social, ethical, cultural, and safety issues in deployment, interpersonal skills for management and team membership, and the software engineering tact of systems architecture.

Course Outcome

The main objective of this course is to introduce the most essential concepts of software engineering and the software development life cycle. The course covers methodological techniques for software specification, design, implementation, testing, verification and documentation. The course also introduces the use of state-of-the-art tools for computer-aided software engineering.

Topics covered in the course

- The software system life cycle
- Ethical and Social Issues
- Computer-based System Engineering
- Software Processes
- Project Management
- Software Requirements
- Requirements Engineering
- CASE Technology
- Specification
- Architectural Design
- System Models
- Verification and Validation
- Software Testing

References and Textbooks

- Sommerville: **Software Engineering**, 7th edition, Pearson 2004-10-31

Databases II (CSEN604)

A-Basic Information

Semester number	Sixth semester
Semester type	Spring semester
Study year	Third year
Course code	CSEN 604
Academic Year	2016/2017
Department offering the course	Computer Science and Engineering (CSEN)
Specialization	CSEN and Business Informatics
Type of course	compulsory
Number of sessions/week	2 Lecture/week, 2 Tutorial/week
Weekly contact hours	2 Lecture/week, 2 Tutorial/week
Student workload	120 hrs.
Credit points (ECTS)	4 CP

Course Aims

Database engines apply many of the important concepts covered in computer science: algorithms, data structures, scheduling, concurrency control, client/server architectures, programming techniques and more. Students will gain in depth knowledge of the internals of a Database Management System to prepare them to be designers, developers and sophisticated administrators of such complex system. Students will learn how a database engine is architected, how to optimize an SQL query, how to work with the query planar, and how and which index structure to select for each table in their system. Students also learn how the database engine recovers from errors and the different types of logging mechanisms employed.

Learning Outcomes

By the end of the theoretical part, the student will be able to:

a. Knowledge & Understanding

a1. Describe how database engines are implemented from the ground up, the different algorithms used and the various internal optimizations made by the developers.
a2. Explain the concurrency control management in a database system
a3. Outline how deadlocks are handled in a database management system
a4. List the recovery mechanisms used in a database management system
a5. Describe how queries are executed internally in a database management system
a6. Identify sources of performance degradation in a database management system
a7. Recognize problems with existing indices
a8. Select best indexing strategy for a database
a9. Estimate the average time to execute a given query for a specific database design
a10. Describe single dimension and multi-dimension data structures used in a database management systems
a11. Outline different query plans and the transformations occurring from one plane to another.

b. Professional & Practical skills

b1. Produce queries that will make better use of existing indexes
b2. Analyze existing statistics for query cost optimization heuristics
b3. Select transaction isolation level programmatically
b4. Select user level authentication level programmatically

b. Intellectual skills

c1. Identify reasons behind performance degradation.
c2. Create indices that will enhance the performance of a database engine
c3. Compose a software application with sophisticated data structures.
c4. Relate information about problem domain to index performance

d. General and transferable skills

d1. Recognizing and identifying views of others and working constructively with them
d2. Capacity to make oral presentation

Content

Topic	Lecture	Tutorial
Intro & Conventional Indices	2	
Indices: B+ Tree	2	2
Indices: Extensible & Linear Hashing	2	2
Indices: KD Tree + Grid + Partition Hash	2	2
Query: physical plan	2	2
Query: physical & logical plans	2	2
Query: physical & logical plans II	2	2
Query: physical & logical plans III	2	2
Failure Handling I	2	2
Failure Handling II + Transactions	2	2
Concurrency Control I	2	2
Concurrency Control II + Tranx + Auth in SQL	2	2

Learning and teaching methods

- Lectures, tutorials, assignments, and project.

Facilities required for teaching & learning

- Lecture hall equipped with microphone, computer, beamer and white board.

Assessment

Student Assessment Methods	Assessment Weighing
Assignments	15%
Quizzes	20%
Final Exam	40%
midterm	25%

References

Essential textbook

Database Systems: The Complete Book (2nd Edition) by Garcia-Molina, Ullman and Widom, ISBN-13: 978-0131873254

Recommended textbook

Database Management Systems, 3rd Edition, by Raghu Ramakrishnan and Johannes Gehrke., ISBN-13: 978-0072465631

Relevant web sites

https://sigmod.org/
http://www.dbta.com
http://www.vldb.org

Code	Nr	Course Title	L	E	P	CP
DMET	602	Network and Media lab	0	0	4	4

Prerequisite Courses
DMET 501

Course Outline

The Network and Media lab is intended to help students learn to extract the theories taught in *regular* courses and apply it to real situations. In addition, new concepts are introduced through hands on experience. Students will be able to construct and configure IP networks, analyze, control and shape network traffic, and be exposed to different application-level protocols that introduce them to exciting applications like video streaming, multicasting, mobile IP.

Course Outcome
By the end of this course, students will be able to:

- Acquire practical understanding of the underlying concepts and principles of computer networks and network protocols
- Acquire understanding of the different network components, how they interact together to provide different application services
- Be familiar with different applications (video streaming, multicasting, mobile-IP)

Lab Experiments

The course consists of 8 experiments + 2 pre-experiments. The experiments cover many network protocols that span from network layer to application layer.

- Pre-experiment 1: Configuring IP network
- Pre-experiment 2: Packet sniffers for network analysis
- Experiment 1: Transmission Parameters
- Experiment 2: Low-level protocols / Broadcast protocols
- Experiment 3: High-level protocols / Dialog based protocols
- Experiment 4: Video Conference systems
- Experiment 5: Video streaming
- Experiment 6: QoS and Traffic engineering
- Experiment 7: Mobile-IP
- Experiment 8: Network simulator: NS-2

7th Semester

Code	Nr	Course Title	L	E	P	CP
CSEN	701	Embedded System Architecture	3	2	0	5

Prerequisite Courses
CSEN601, CSEN 605

Course Outline

This course introduces students to the fascinating world of embedded systems design. The course capitalizes on the wealth of computing knowledge that students have acquired and helps them develop new design and analysis skills geared towards the design and implementation of an important class of systems: namely embedded systems.

Topics covered in the course:

The growing market for embedded applications has created a strong need for computer engineers and scientists trained in this area. To address this need, this course presents a balanced treatment of software and hardware design and development issues that arise in the context of building embedded systems. These issues include

- Embedded hardware
- Networking embedded systems,
- Standards guiding the development of these systems,
- Safety and reliability of software and hardware,
- Software and hardware co-design,
- Real-time scheduling,
- Power management, and
- Impact of the current technology on embedded designs.

The laboratory component of this course introduces embedded programming environments, microcontroller-based systems, and wireless sensor networks.

Code	Nr	Course Title	L	E	P	CP
DMET	502	Computer Graphics	2	2	2	6

Prerequisite Courses
CSEN201, CSEN301

Course Outline

This is a basic graphic course that exposes students to the broad field of computer graphics. The main focus is on the fundamental graphic algorithms. The course presents an introduction to the basic concepts of 2D and 3D graphics

Topics covered in the course:

- Graphics primitives
- Solid modeling
- 2D and 3D transformations
- Curves and surfaces
- Projection (perspective, parallel)
- Hidden surface removal
- Mapping techniques
- Color Specification and Use
- Lighting and shading

References and Textbooks

- James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes, **"Computer Graphics: Principles and Practice,"** 2nd ed., Addison-Wesley, ISBN: 0201848406.
- Peter Shirley, **"Fundamentals of Computer Graphics,"** 2nd ed., A.K. Peters, 2005, ISBN: 1568812698.

Code	Nr	Course Title	L	E	P	CP
CSEN	703	Analysis and Design of Algorithms	2	2	0	4

Prerequisite Courses

CSEN301, MATH502

Course Outline

The course is an advanced undergraduate course in the art and science of algorithm analysis and design. Students are introduced to algorithm complexity analysis. Although space and work complexity are touched upon, the main concentration is on time complexity. Methods for carrying out asymptotic analysis and for solving recurrence equations are covered in detail. Students are acquainted to major methodical algorithm design techniques: divide-and-conquer, dynamic programming, greedy algorithms, etc. Parallel models of computation (PRAM, Mesh, Tree, Hypercube) are introduced, and fundamental parallel algorithms are discussed and analyzed for each model (parallel prefix, broadcasting, rotation, etc.) Throughout the course, examples of classical and state-of-the-art algorithms are provided for illustration. Example algorithms are selected from fields such as graph theory, DNA alignment, computer arithmetic, and data compression.

Course Outcome

- Mathematical Preliminaries.
- Divide-and-Conquer
- The Master Theorem
- Dynamic Programming
- Greedy Algorithms
- PRAM Algorithms
- Algorithms for Interconnection Networks

By the end of this course, students will develop the rigor and skills required to precisely present and analyze algorithms, both sequential and parallel. Students will be able to prove tight asymptotic bounds on the time complexity of algorithms. This subsumes being able to solve recurrence equations in the case of recursive algorithms. By presenting them to a host of examples and exercises, students should be able to design algorithms using any of the algorithm design methods covered in the course..

After passing this course, students should be able to

- Rank functions asymptotically.
- Solve recurrence equations
- Design and analyze greedy algorithms
- Design and analyze divide-and-conquer algorithms
- Design and analyze dynamic programming algorithms
- Design and analyze PRAM Algorithms
- Design and analyze mesh algorithms
- Design and analyze tree algorithms
- Design and analyze hypercube algorithms

References and Textbooks

- **Foundations of Algorithms Using Java Pseudocode**
  Richard Neapolitan and Kumarss Naimipour.
  ISBN 0-7637-2129-8

Code	Nr	Course Title	L	E	P	CP
CSEN	702	Microprocessors	3	2	0	5

Prerequisite Courses
CSEN203, CSEN402, CSEN601, CSEN 605

Course Outline
In this class, we will have a broader view of processor architectures including the memory and I/O subsystems. The class emphasizes the use of simple analytical methods to bound the design space before the use of extensive simulations. We model general systems with multiprocessors and shared memories using the queuing theory and analyze the performance and associated costs. We will look at practical design targets given the current trends in the technology and look at their area, time, and power consumption.

Course Outcome
By the end of the class, the student should be able to balance the performance and cost of processor designs through analytical means before engaging in extensive simulations.

- Basics and evaluation metrics: Design of instruction sets, historical examples, area and time tradeoffs, technology trends, economics of a processor design, metrics.
- Programs and processors: Multimedia, networking, security, and number crunching programs behave differently. How does that affect the design of a processor?
- Memories and queuing models: Cache organizations and models, effect of technology on memories, cache and memory interleaving, queuing models.
- Concurrent processors: vector and out-of-order processors, multiprocessors, shared buses, interconnection network.
- Input and Output: Networks, I/O systems, disk arrays

References and Textbooks

- Computer Architecture: Pipelined and Parallel Processor Design, Michael J. Flynn; Published by Jones and Bartlett, 1995.

Code	Nr	Course Title	L	E	P	CP
CSEN	704	Advanced Computer Lab	0	0	4	4

Prerequisite Courses
CSEN602 or CSEN603 or CSEN604

Tools

- Go Programming Language.
- Android Studio.

Course Outcome
The course intends to introduce the concepts of designing well-structured mobile applications. The full cycle of the application development is discussed thoroughly starting from implementing the back-end services requested by the apps to the design of the application layout in the Android platform.

9th Semester

Code	Nr	Course Title	L	E	P	CP
DMET	901	Computer Vision	2	2	0	4

Prerequisite Courses
CSEN202, CSEN301, CSEN401, MATH203

Course Outline
This course presents the field of Computer Vision from a Computer Science viewpoint. The basic concepts of Image Processing should be addressed as many of these concepts are essential to device good vision algorithms. The purpose of this course is to gain a perspective of the current Computer Vision topics to help the student prepare for advanced research studies in this field.

Topics covered in the course:

- Types of images
- Image arithmetic: addition, subtraction, multiplication, division, blending
- Geometric operations: scaling, rotation, reflection, translation
- Image enhancement: histogram, histogram equalization, contrast stretching
- Digital filters: noise, noise reduction with smoothing filters, mean filter, median filter, Gaussian filter, etc.
- Feature detectors: edge detectors (Roberts, Sobel, Compass, Canny, Zero Crossing), line detectors, corner detectors (Harris, SUSAN), junction detectors.
- Image analysis: classification, labelling, segmentation, pyramidal architecture
- Morphology: dilation, erosion, opening, closing
- Projective geometry: points, lines, planes, directions, homogeneous coordinates, camera model, projection matrix
- Stereo vision: disparity estimation, epipolar geometry, fundamental matrix, essential matrix, homography matrix, affine matrix, 3D transformation
- Point matching: calibrated versus uncalibrated matching, short versus wide baseline matching, correlation techniques (ASD, SAD, VNC), Random Sample Consensus
- 3D reconstruction: types of 3D reconstruction, 3D point reconstruction and triangulation, 3D line reconstruction, voxelization
- Motion, object recognition and tracking

References and Textbooks

- JD. A. Forsyth and J. Ponce**, "Computer Vision: A Modern Approach ,"** Prentice Hall, Upper Saddle River, N.J., 2003.
- Trucco and Verri, **"Introductory Techniques for 3¬D Computer Vision,"** Prentice Hall 1998.

Code	Nr	Course Title	L	E	P	CP
CSEN	1095	Data engineering	4	0	0	4

Prerequisite Courses
None

Course Description
This course aims at providing the students with a solid understanding of the importance and the techniques for data processing and preparation for data science and machine learning tasks, as well as the fundamentals of big data platforms that can be used to host and process data at scale.

Course Outline

1. Introduction to data engineering
2. Data exploration and exploratory data analysis
3. Data cleaning and imputation
4. Data transformation
5. Data reduction
6. Feature engineering
7. Data integration
8. Big data platforms and the Hadoop ecosystem
9. Building and automating data pipelines
10. Spark architecture

Course Outcome
This course seeks to develop students who:

- understand the principles of data preparation and processing.
- can apply different data cleaning and transformation techniques.
- can engineer features with potential utility to data analysis tasks.
- understand the concepts and the functional elements of big data architectures.
- can build data pipelines.
- can deploy Spark clusters and perform data processing tasks on them.

References and Textbooks

1. Designing Data-Intensive Applications, Martin Kleppmann, O'Reilly Media, 2017.

2. Feature Engineering for Machine Learning, Alice Zheng and Amanda Casari, O'Reilly Media, 2018.

Code	Nr	Course Title	L	E	P	CP
CSEN	901	Artificial Intelligence	2	2	0	4

Prerequisite Courses
None

Course Outline
- Introduction to Artificial Intelligence
- Production Rule Systems
- Knowledge Representation and acquisition
- Semantic networks
- Frames
- Logic
- Reasoning with uncertainty (Bayes' Rule, belief nets)
- Search
- Planning
- Non-standard logics
- Sub-symbolic AI
- Applications/ Conclusion

Course Outcome
A student completing this course should
1. be able to read and write (at least simple versions of) the major knowledge representation formalisms;
2. be able to explain, compare, and use the major search and planning techniques;
3. understand the basic idea of uncertainty, and be able to perform qualitative and quantitative uncertainty calculations using simple Bayesian algorithms and belief networks;
4. be familiar with the design of Knowledge Based Systems (KBSs) and production rules, through study of classic exemplars;
5. be able to implement a simple forward chaining KBS
6. understand the limitations of AI, which problems are still hard, and why;
7. understand the principal ethical and social issues in AI research and development.

References and Textbooks
S.J. Russell, P. Norvig: Artificial Intelligence – A Modern Approach, Prentice-Hall 1995

Code	Nr	Course Title	L	E	P	CP
CSEN	903	Advanced Computer Lab	0	0	4	4

Course Abstract

The course is designed to make students familiar with using Unity3D for creating cross platform 3D applications. Throughout the course we focus on multiple aspects in Unity3D, from light to graphics to the physics engine to writing code in order to manipulate the 3D environment. The course also focuses on manipulating 3D models through texturing materials and animating generic and humanoid 3D models in scenes.

10th Semester

Code	Nr	Course Title	L	E	P	CP
HUMA	1001	Project Management	2	2	0	4

Prerequisite Courses
None

Course Outline

- Introduction: Principles of quality management, basic terms, methods and tools
- Six Sigma: DMADOV implementation process
- Quality Standards: The ISO 9000 family, quality system models, ISO 9000 derivatives
- Quality Management Outlines: TQM, Mahalanobis-Taguchi strategy, Kaizen
- Project Management
- Project Planning: Developing a implementation plan, MRP, BOM, MPS, JIT
- Project Control: Network diagrams
- Project Cost: Cost quality issues and tools, including Earned Value Management
- Robust Engineering: Quality and project management methods of car manufacturers in Japan and Europe

Course Outcome
The students are familiar with the contents of the most important standards as for example ISO 9000. They have understood the importance of project management concerning their future work. They know the tools of quality management and the importance of quality assurance.

References and Textbooks

- Geridi Taguchi, Rajesh Jugulum: The Mahalanobis-Taguchi Strategy, Wiley, 2002
- Lewis, James P.: Project Planning, Scheduling and Control, McGraw-Hill, 2001
- Kathy Schwalbe: Information Technology Project Management, 2nd edition (with CD), Course Technology/Thomson Learning, Boston, c2002

Code	Nr	Course Title	L	E	P	CP
CSEN	1001	Computer and Network Security	2	2	0	4

Course Outline

The course will cover three areas:
Security risks and countermeasures, principles of computer cryptography, and applied cryptography

- Overview, vulnerabilities, risk assessment, incidents, forensics.
- UNIX vulnerabilities and safeguards
- Hash functions (MD5, SHA, RIPEM,Whirlpool)
- Authentication and authorization
- Network security (BSDisms, sniffers, wrappers, vpns, firewalls, intrusion detection)
- Kerberos, trusted systems, secure OS
- Cryptography, steganography, number theory, random numbers
- Secret key encryption (DES, IDEA, RC5, CAST, AES(Rijndael))
- Public key encryption (Diffie-Hellman, RSA, ECC, DSA)
- key management, PKIs
- OpenSSL and crypto API's, writing secure software
- secure applications: PGP, S/MIME, ssh, netscape/SSL, IPsec
- Issues: legal/political/ethical

Code	Nr	Course Title	L	E	P	CP
CSEN	1002	Advanced Computer Lab	0	0	4	4

Abstract

This course provides a practical introduction to the implementation of compilers. The course is carried out as one programming project divided into four milestones. Each milestone will consist of one component of the compiler that will be built during the course. At the end of the course, the implemented compiler will be capable of generating executable code for the JVM or other possible machine architectures.

Course Outline

The lab problems include the following:

1. Lexical Analyzers:
   - Implementing a lexical analyzer manually from scratch.
   - Implementing a lexical analyzer using JLex.
2. Syntactic Analyzer:
   - Implementing a parser manually from scratch.
   - Implementing a parser using CUP.
3. Semantic Analyzer:
   - Generate a syntax tree manually from scratch.
   - Generate a syntax tree using CUP.
4. Code Generator:
   - Generation of machine code (JVM or MIPS).

Objectives

By the end of his course, students will know how to implement lexical, syntactic and semantic analyzers, manually and using automation tools such as JLex and CUP. They will also have learnt to implement a full compiler for the Decaf programming language.

Code	Nr	Course Title	L	E	P	CP
CSEN	1003	Compiler	2	2	0	4

Prerequisite Courses
CSEN102, CSEN 202, CSEN 301, CSEN 501

Course Outline
This course is designed to explore the basic concepts of the design and implementation of a modern compiler. The course provides an overview of the techniques used in designing compilers. These techniques include parsing techniques, symbol manipulation, code generation, error handling and code optimization techniques.

Course Content
Topics covered are as follows:
1. Overview of a Compiler structure
2. One pass compiler
3. Lexical analysis
4. Syntax analysis
5. Parsing Techniques
    a. Top-down parsing
    b. Bottom-up parsing
6. Syntax-Directed Translation
7. Type checking
8. Intermediate Code Generation
9. Code Generation
10. Code Optimization

Course Outcome
Upon completing this course, the students will be able to:
1. Recognize and understand grammars and formal languages and their applications in compiler writing
2. Analyze the process involved in the design of a high-level programming language;
3. Implement a variety of parsing techniques
4. Run semantic and syntax analysis of a programming language
5. Understand error detection and recovery
6. Understand code generation and code optimization;

References and Textbooks
Wilhelm, Maurer: Compiler Design, Addison-Wesley, 1995

Aho, Sethi and Ullman. Compilers: Principles, Techniques, and Tools.Addison Wesley, 1986.

Code	Nr	Course Title	L	E	P	CP
CSEN	1038	Advanced Data Structures and Algorithms	2	0	2	4

Prerequisite Courses
None

Abstract

The advanced Data Structures and algorithms course builds on CSEN703 making use of the algorithms learned to explain and open the gate to more complex data structures and algorithms. Runtime optimization is one of the most important aspects of program design which makes the selection of an appropriate data structure or algorithm crucial in the design process. The course will cover a broad range of topics that are essential for a computer scientist to know including: Important topics of Number Theory, Graph Algorithms, String Algorithms, Search Algorithms and Complex Data Structures. A solid background in algorithms will be assumed and further knowledge will only be built on it.

Course Outline

Important Topics in Number Theory. Important Topics in Number Theory (Cont.) Strongly connected components and 2-SAT problem. Line Sweep Algorithms Heavy Light Decomposition and Lowest Common Ancestor. String Algorithms and Tree Data Structure Suffix Arrays Segment Tree Ternary Search and Binary Search. Self-Balancing Binary Search Tree Skip Lists Network Flow and Stable Marriage Problem. Combinatorial game playing and Grundy numbers.

Code	Nr	Course Title	L	E	P	CP
CSEN	xxx	Knowledge Representation and Reasoning	2	2	0	5

Course Outline

Cognitive science is the modern, empirically based study of mind. It is a multi-disciplinary effort carried out by philosophers, psychologists, linguists, neuroscientists, anthropologists, and, crucially, computer scientists. Computer scientists attempt to construct computational theories of the mind. Such theories are invaluable since they are directly testable by simply running a program.