INTERNATIONAL UNIVERSITY OF SARAJEVO

FACULTY OF ENGINEERING AND NATURAL SCIENCES

UNDERGRADUATE COURSE DESCRIPTIONS

A

ARCH100 Introduction to Architectural Design **ECTS 6**

This course aims to develop the students' capability to design different functional units in one individual house such as functional units for living and working, sleeping and kitchen, by using architectural standards, regulations and architectural language.

ARCH101 Basic Design Communication **ECTS 6**

This course aims to develop and demonstrate essential communication skills and to teach students how to present their design ideas graphically and in the form of the simple model. Principles of sketching, 2D orthographic projection and perspective drawings, simple model-making of building proposals, written and verbal communication and information literacy will be integrated within the design process and communication.

ARCH102 History of Architecture I **ECTS 6**

The history, theory and context of architectural practice from prehistory up to an including the Gothic is discussed at this course. Students will be introduced to the development of architectural practice and the contexts and ideologies that helped shape it via lectures, seminars and selected readings.

ARCH106 Introduction to Building Technology **ECTS 6**

The course aims to introduce students to fundamental concepts and principles of building construction, materials and techniques, to get students acquainted with elements of construction technologies, and to introduce students to technical presentation of small buildings.

ARCH108 Introduction to Architectural Design II **ECTS 6**

Students will learn the fundamentals of the design of an individual house in studio-based lectures. They will learn the design of houses by applying architectural standards, regulations, and architectural language. Students will be tasked to design a semi-detached dwelling on a define site for the chosen project that fits the needs of contemporary life. *Prerequisite: ARCH100*

ARCH109 Basic Design Communication II **ECTS 3**

The course teaches students visual literacy and understanding of design principles and elements. The course aims to increase students' awareness of the creative process. It equips them with the skills and knowledge of tangible realizations of conceptual ideas using appropriate tools, applications and techniques, such as drawing, painting, collage, photography, and model. *Prerequisite: ARCH101*

ARCH110 Freehand Drawing **ECTS 3**

This course introduces students to the skills of hand drawing; the perspective, foreshortening, proportion, relation of geometric bodies among each other and their correlation with environment.

ARCH201 Architectural Studio I **ECTS 12**

The course establishes foundations for architectural design of individual and collective housing in an existing urban setting engaging issues of space, organization, circulation, use, structure and material. The studio investigates the concept of housing design in an urban context through a series of design exercises within small tutorial groups. *Prerequisite: ARCH108*

ARCH202 Architectural Studio II **ECTS 12**

To provide students with general introduction to the fundamentals of collective housing design making a project consisting of housing, commercial and business areas. Students are exposed to contemporary contextual urban challenges, where students train to link urban site and context with program requirements. Integration of housing, commercial and business activities is main topic of this studio. Students are also trained to develop graphic and three-dimensional skills. *Prerequisite: ARCH201*

ARCH203 Building Services I **ECTS 4**

This course aims to equip students with knowledge and understanding of principal services in domestic and commercial buildings such as sewage system or water supply. The course looks closely at the applications of some common elements of building services practice, technique and procedure with illustrations, design examples, tables and charts and theory. *Prerequisite: ARCH106*

ARCH204 Structural Design I **ECTS 4**

This course introduces students to fundamental concepts and principles of structures in buildings. The course's intention is to equip students with knowledge on basic structural elements and simple structural systems. *Prerequisite: ARCH106*

ARCH208 Architectural Communication **ECTS 6**

This unit of study introduces experimental analogue and digital technology into modes of architectural communication. It re-considers imagery, modeling, and verbal and written communication through computer aided operations, interfaces and projective techniques.

ARCH209 History of Architecture III **ECTS 4**

The course intends to equip students with skills and competence to develop creative solutions to the professional challenges based on the appropriate level of knowledge of the ideas and practices of Modern and Contemporary Architecture in the diverse regional and historical contexts. *Prerequisite: ARCH217*

ARCH210 Structural Design II **ECTS 4**

This course aims to provide students with fundamental concepts of basic design of building structures and the use of major construction materials. Students will be exposed to concepts of both concrete and steel design at the element and system levels. An understanding of practical design issues will be developed.

Design skills will be learned through problem sets and a comprehensive design project. *Prerequisite: ARCH204*

ARCH211 Building Services II **ECTS 4**

This course is intended to equip students with understanding of what is meant by 'human needs to have quality life'. Students will learn, inter alia, about service facilities in buildings, safety issues and functionality of buildings, topology of buildings, how to use appropriate norms.

ARCH216 Introduction to CAD **ECTS 4**

This course covers computer aided design and presentation of 3D modeling, for design and documentation. Students gain competences in visualizations of design objects, develop computing skills in the use of AutoCAD and demonstrate visual and verbal communication skills. This course will develop computing skills in the use of 3D modeling tools in *SketchUP*. After successful completion of the course students will be able to produce computer generated and multilayered 2D design and construction drawings; complete with dimensions, notations and conventional drawing graphics; 3D parallel and perspective representations with shaded, coloured or rendered surfaces as well as static and dynamic presentations.

ARCH217 History of Architecture II **ECTS 6**

This course aims to strengthen the students capacity for developing creative and responsible solutions to the professional challenges based on the appropriate level of knowledge of the ideas and practices of architecture from 15th century to the modern time (19th century) in the diverse regional and historical contexts with an introduction of Islamic architecture from the Umayyads to the Mamluks, the Ottomans, and their European contemporaries. *Prerequisite: ARCH102*

ARCH302 Urban Design and Planning **ECTS 6**

This course provides a critical investigation of the central issues and challenges of contemporary urban design. It will present how urban design has guided public interventions in the built environment and why it is expected to improve the physical characteristics of the built environment. This course will emphasize current principles and trends of urban design that have to be adapted to an increasingly complex urban agenda. To understand how urban design responds to contemporary urban challenges and issues, we will need to examine some of the theories and models that have influenced the professional practice of urban design. *Prerequisite: ARCH201*

ARCH303 Architectural Design Studio III **ECTS 12**

The aim of this course is to advance the student's design knowledge, skills, and values. The application of research and theory to design residential complexes and spaces with strong connections to their urban context is central to this course. Students will address its relationship to its urban context and how such relationship may influence the building function, form, and apartment layout. The project will focus on designing a building that makes a substantial visual and physical impact on its urban context such that it becomes a community hub for that area and a focal point in its complex. The project design is expected to ensure that its serves the 21st century residential needs while fitting in appropriately to the complex setting and that its employs appropriate technology to produce sustainable environment and buildings. *Prerequisite: ARCH202.*

ARCH304 Architectural Design Studio IV **ECTS 12**

This studio is focused on innovative approaches to design as art and science and on the integration of a strong theoretical foundation in architecture and urban design with real world professional practices. The application of research and theory to design educational buildings and spaces with strong connections to their urban context is central to this course. The aim is to foster the development of critical thinking and architectural design skills of buildings with complex program requirements and connections to their urban context. *Prerequisite: ARCH303.*

ARCH307 Sustainable Design **ECTS 4**

The main theme of the course is to examine the predicament of contemporary architectural endeavor as an ecologically sustainable activity. It involves a survey of passive "technologies" and an examination of the current theoretical approaches to sustainability that have been recently defining the emerging models of sustainable design practice at both, the architectural and urban design level. Through leading-edge case studies, this course will critically examine concepts, theories, and practices across multiple scales of sustainable design, including architecture, landscape architecture, urban planning, and urban design. *Prerequisite: ARCH202.*

ARCH308 Urban History **ECTS 4**

The course aims to introduce students to certain historical developments within urban development from prehistory up to and including the twentieth century. Students will be provided with contextual information adding to lecture notes via PBWorks. In order to satisfy the assessment criteria students will be expected to be able to identify key aspects of historical urbanism and styles and demonstrate understanding of urban development contexts. *Prerequisite: Junior Standing (108 ECTS)*

ARCH311 Materials in Architecture **ECTS 4**

This class aims at providing students with a critical role of materials and methods for the design and construction of buildings. The primary focus is on material properties, their relationship to building systems, connections and environmental performances. Students will develop a basic understanding of relationship of materiality to construction techniques, and how materials influence the design process. Regular assignments experience and skills will be gained and learned through problem sets including a comprehensive design project.

ARCH312 Building Construction **ECTS 4**

The course aims to introduce students to the principles of building systems, construction methods and techniques. Students will be familiarized with structural as well as finish works to be implemented in a construction process. *Prerequisite: Junior Standing (108 ECTS)*

ARCH352 Bioclimatic Architecture **ECTS 4**

This course deals with environmentally friendly architecture. It provides an insight into architectural context in which, on one hand, the usage of water, various sources of energy, and construction materials is considered by its impact on the environment and on the other while aesthetics and design principles are preserved. *Prerequisite: Senior Standing (168 ECTS)*

ARCH353 Self Study Design Project **ECTS 4**

The course equips students with the knowledge on design fundamentals and aims to develop the students' skills and competences to design buildings for different purpose by using architectural standards, regulations and architectural language in the demanding environment. *Prerequisite: Senior Standing (168 ECTS)*

ARCH354 New Design in Old Settings **ECTS 4**

This course will treat some of important aspects of architectural existing context and introduces students to new design in existing urban or natural context on the given site. Students will develop skills for reinterpretation and respect of tradition and existing, they will understand importance of previous in architecture. By the end of the unit the student will successfully demonstrate knowledge about architectural history and shapes of some space and understanding of appropriate approaches to the design of new buildings in old settings and the conservation issues that arise from such design proposals. *Prerequisite: Senior Standing (168 ECTS)*

ARCH355 Advanced Urban Design **ECTS 4**

The course encourages students to investigate and think critically about contemporary features of urban design and international practice. *Prerequisite: Senior Standing (168 ECTS)*

ARCH356 Landscape Design **ECTS 4**

This course confronts students with the main issues in the landscape design development. Students learn how to build appropriately, through the analysis of the landscape and the climate for a chosen site and to conceptualize design decisions through drawings and models. The main task is to explore the main concepts and methods used in the landscape design process, to design a place for the community and privacy and to provide a research based on the individual observation of the existing landscape and urban spaces. *Prerequisite: Senior Standing (168 ECTS)*

ARCH357 Bosnian Architecture **ECTS 4**

This course will cover some of the most fundamental aspects of architectural history in Bosnia and Herzegovina. The students will develop skills for reinterpretation of tradition; they will understand importance of previous in architecture. By the end of the unit the student will successfully demonstrate knowledge about architectural history of some space and understanding of appropriate approaches to the new design in existing environment. *Prerequisite: Senior Standing (168 ECTS)*

ARCH360 Digital Architecture and Fabrication **ECTS 4**

Students will be instructed in the principles of 3-D modeling using Rhinoceros NURBS modeling software. In a laboratory setting, students will have an opportunity to practice the strategies and methods commonly used in creating and solving 2-D and 3-D geometric problems. Information given in lectures and demonstrations will address aspects of modeling free-form curves, surfaces, and solids. Students will be introduced to a variety of 3-D model applications as they are used in illustration, engineering, design, documentation drawing, entertainment, and animation. *Prerequisite: Junior Standing (108 ECTS)*

ARCH371 Descriptive Geometry **ECTS 4**

Descriptive geometry finds its real life application in architecture, engineering and science. It deals with physical environment where all the things we can see around us and their relations are perceived from geometrical point of view. Descriptive geometry course teaches students to solve problems in three-dimensional geometry by generating two-dimension pictures. *Prerequisite: Junior Standing (108 ECTS)*

ARCH372 Compositions in Architecture **ECTS 4**

The course aims to introduce students to advanced architectural composition. Students will learn the principles of composition and complex relations between various forms and as well as their impact on the surroundings. The course is design to improve students' critical thinking in design and decision making in the field of architectural form. *Prerequisite: Junior Standing (108 ECTS)*

ARCH373 Interior Design **ECTS 4**

Interior Design course is seen as an introduction to the theories and practices of contemporary interior design. Students will acquire an understanding of the theories, concepts and techniques employed by interior designers, allowing them to utilize the same skills and knowledge in their own designs. *Prerequisite: Junior Standing (108 ECTS)*

ARCH375 Perspective and Shadows **ECTS 4**

Students will explore light, shade and shadows through practical sketching as well as by experimenting with 3D Digital Technology. *Prerequisite: Junior Standing (108 ECTS)*

ARCH376 History of Art **ECTS 4**

The history, theory and context of art practice from prehistory to and including the twentieth century. Students will be introduced to some of the most significant developments in the visual arts and gain and understanding of how they might be interpreted and how themes represented and techniques employed have been utilized in architectural practice. *Prerequisite: Junior Standing (108 ECTS)*

ARCH377 Architectural Anthropology **ECTS 4**

The course seeks to explore commonalities between two fields, architecture and anthropology, such as spatial organization, forms of human habitation and accommodation, human interaction and social environment. The course also seeks to encourage students to think about significant differences, which may be reflected through temporality, communication and normatively. *Prerequisite: Junior Standing (108 ECTS)*

ARCH380 Work Placement/Internship[1] **ECTS 6**

[1] An internship experience provides the student with an opportunity to explore career interests while applying knowledge, skills and competences gained in the classroom in a work setting. The experience IMPORTANT NOTE ON WORK PLACEMENT: The student is expected to: 1. Familiarise himself/herself with the IUS Procedures and Rules for Work Placement/Internship 2. Arrive at work as scheduled, ready to work, and stay for the agreed upon time 3. Present him/herself in a professional manner at all times, including being appropriately dressed for a particular workplace. 4. Communicate any concerns with their supervisor and the internship coordinator in a timely manner and respectfully. 5. Demonstrate enthusiasm and interest in what the company is doing; ask questions and take initiative as appropriate. 6. Complete and submit their internship file by designated deadlines. 7. Keep track of and accurately report internship hours worked. (Completion of the work is assigned by the employee. Report of the performed work is also checked by the Program

Work placement aims to expose students the real working environment. Students are expected to familiarize themselves with the real building construction sites and building techniques or the design office environment. During the work placement students are expected to appraise various construction phases during the building construction process, examine relations in studio design office environment, compare various design phases as well as their accuracy and quality, and create the presentation of designs ideas graphically and verbally for various design phases.

ARCH401 Architectural Heritage Conservation **ECTS 4**

This course aims to expose students to the multidisciplinary and interdisciplinary nature of sustainable integrated conservation as well as to stimulate and encourage intellectual inquiry and research of cultural heritage so as to ensure students develop basic knowledge on heritage protection required to function as responsible architects and urban planners in the historic environments.

ARCH402 Contemporary Architectural Theory **ECTS 4**

The course deals with an analysis of theories affecting architectural practice from the modern through to the postmodern. Students will gain an understanding of how changes in architectural and critical theory have shaped architectural practice.

ARCH403 Management in Architecture **ECTS 4**

The course will provide students with the sound view of project management in general and its tools and techniques, the relationship between project management and architectural design, management and follows up of construction project, way it matters and how to achieve the best practice in the field of management in architecture. It will introduce different project phases and activities necessary for successful project completion. Students will understand the significance of the project management and its relation to design and construction process and the roles of the different participants in the construction project life cycle.

ARCH405 Architectural Design Studio V **ECTS 12**

The objective of the unit is to prepare a schematic and developed design for complex public building project with an emphasis on interrelationships of spaces and specialist functions, including, public interface, public assembly and functional performance. Projects will have an emphasis on designing in a 'heritage' site with a range of environmental issues. On successful completion of this unit of study students will develop concepts to justify a design with references to an urban site as well as strategies for public buildings. *Prerequisite: ARCH304*

ARCH406 Final Design Studio **ECTS 12**

In this course, students will have worked closely with a tutor on a unique project, absorbing the key issues informing the project and demonstrating an ability to translate these issues into a design project. The objective of the unit is to prepare a schematic and developed design for complex residential or public building project with an emphasis on interrelationships of spaces and specialist functions, including, public

Coordinator at the end of the semester. The internship could be evaluated as ACCEPTED, REJECTED or INCOMPLETE. In order for students to receive 6 ECTS, the internship report needs to be ACCEPTED.)

interface, public assembly and functional performance. On successful completion of this unit of study students will develop concepts to justify a design with references to an urban site as well as strategies for public buildings. Students will be able to identify the functional needs and uses of public buildings and present ideas and designs graphically and verbally. They also develop knowledge for analysis of design theories, processes and architectural positions and develop the ability to use them creatively. *Prerequisite: ARCH405*

ARCH408 Building Physics **ECTS 4**

This course aims to equip students with the skills and competences so that they learn how to analyze building interior environment and determine occupant comfort, analyze heat and moisture transport through building envelope, assess potential heat bridges in building envelope, and to combine building materials to achieve optimum building operation.

ARCH411 Lightning and Acoustics **ECTS 4**

The course seeks to equip students with understanding of scientific principles of architectural lightening and acoustics and their application in different stages of design and construction processes. *Prerequisite: Senior Standing (168 ECTS)*

ARCH412 Advanced Building Construction **ECTS 4**

This course aims to develop the students' capability to recognize, find and apply the proper construction systems and material for complex buildings, addressing the huge spans and demanding structures challenges. *Prerequisites: ARCH210, ARCH312*

ARCH413 Principles of Facade Construction **ECTS 4**

This course deals with instructing students in technologies used in façade constructions, performance requirements, primary and secondary insulation, façade as exterior interface and as a user comfort. *Prerequisite: Senior Standing (168 ECTS)*

ARCH414 Introduction to Islamic Architecture **ECTS 4**

This course aims to provide students with a fundamental understanding of Islamic architecture through major dynastic periods. The primary focus is on the formation and background of Islamic architecture, then major forms, styles, and decoration of a certain period. Students will also learn architectural characteristics of major monuments, from the formation period, through classical age, and until the end in XVIII century. *Prerequisite: ARCH207*

ARCH415 Conservation Methods **ECTS 4**

This course seeks to explore the established stages of architectural conservation of buildings, and challenges students to critically think about the importance of building conservation.

ARCH416 Issues in Contemporary Architecture and Urban Design Practice **ECTS 4**

The course seeks to engage students in the critical thinking about contemporary development challenges, which demand for architecture response. Contemporary issues, such as climate change, social crises, migration, architecture solutions and students will be challenged to approach them in interdisciplinary manner. *Prerequisite: Senior Standing (168 ECTS)*

ARCH417 History of Design **ECTS 4**

The history, theory and context of design practice from the industrial revolution up to and including the twentieth century. Students will be introduced to some of the most significant developments in design practice and gain and understanding of how they might be interpreted and how themes represented and techniques employed have been utilized in architectural practice. *Prerequisite: Senior Standing (168 ECTS)*

B

BIO301 Molecular Biology **ECTS 6**

The purpose of this course is to provide students with a thorough background and understanding of the basic principles of molecular biology. The lectures cover molecular biology from the history and the "central dogma" to eukaryotic and prokaryotic DNA biosynthesis; chromosomal structure and function and eukaryotic and prokaryotic gene structure and function (DNA replication, transcription and translation), and how they relate to basic biological and chemical concepts. After successful course completion, the students will have chance to learn biology laboratory techniques (see BIO312).

BIO303 Genetics II **ECTS 6**

This course aims to improve students' understanding of genetics at molecular level. It also provides information to extend their knowledge about different genetics related issues and to help them thinking in an analytical way.

BIO304 Structural Biology **ECTS 6**

This course provides an opportunity for students to establish or advance their understanding of research through critical exploration of research language, ethics, and approaches. The course introduces the language of research, ethical principles and challenges, and the elements of the research process within quantitative, qualitative, and mixed methods approaches. Participants will use these theoretical underpinnings to begin to critically review literature relevant to their field or interests. *Prerequisite: Junior Standing (108 ECTS)*

BIO305 Biochemistry II **ECTS 6**

The course covers the study of the biochemical reactions with an emphasis on metabolism of carbohydrates, lipids, amino acids and nucleotides, and the chemistry of signal transduction. Further, it includes critical thinking and analytical skills to solve problems and discuss cases related to metabolism and disease by acquiring and synthesizing scientific information from a variety of sources. *Prerequisite: NS207*

BIO306 General Microbiology **ECTS 6**

Topics include general principles of microbiology, structure and function of microbial cells, growth and control of microorganisms. Also, molecular biology of bacteria and archaea is briefly explained during the courses. Further, the course covers in detail viruses including viral structures, classification of viruses and host invasion, as well as the principles of microbiology with emphasis of industrial application of microbiology (food science, agriculture and biotechnology) and human disease.

BIO307 Bioengineering Principles **ECTS 6**

This course covers the fundamental principles of design, application and optimization of biologically relevant processes. Special emphasis is given to the thermodynamics of bioreactors besides to scale-up, monitoring, measurement and control of bio-reaction and subsequent purification of bio-products. *Prerequisite: Junior Standing (108 ECTS)*

BIO308 Plant Structure and Physiology **ECTS 6**

This course explores the principles of the structural organization and function of plants emphasizing cellular structure and physiology, anatomy, genetics, growth and the diversity of plants. This course covers the morphology and anatomy of plant parts (roots, stem, leaves). In addition, the modification of plant parts will be covered in relation to cells and tissues of plants. The physiology part covers the main physiological processes; plant –water relationship, photosynthesis, respiration, plant growth regulators and secondary products. The objective of the course is to understand functional relations between plant structure and physiology processes. Further, in correlated environmental influences on the rate of physiological processes in plants by discussing physiological processes in plant and mechanism of plant defense. *Prerequisite: Junior Standing (108 ECTS)*

BIO309 Bioethics **ECTS 6**

This course explores ethical questions that arise in bio-engineering and the biological sciences. Course considers the following issues (perhaps together with others): the social responsibilities of bioengineers, sampling patient's bio-materials, reproductive ethics, personalized medicine and the use of technologies for genetic screening and manipulation. Throughout, the course focus will be on moral questions about how decisions in these domains should be made. *Prerequisite: Junior Standing (108 ECTS)*

BIO310 Bioinformatics **ECTS 6**

This course introduces students to the usage of biological databases and available software in order to study biological phenomena. It begins by covering nucleic acid and protein primary sequences, and their study from various aspects, including pair wise and multiple sequence alignment, search for conserved regions and phylogenetic tree construction. Later, the focus shifts on proteins and the analysis of their secondary and tertiary structures, as well as domains, in order to study the function of proteins. Finally, this course also covers interactome analysis, which is the study of interactions between different proteins. *Prerequisite: NS103*.

BIO311 Biosensors **ECTS 6**

The course is intended to provide a broad introduction to the field of biosensors, design and performance analysis. Fundamental application of biosensor theory will be demonstrated, including recognition, transduction, signal acquisition, and post processing/data analysis. *Prerequisite: Junior Standing (108 ECTS)*

BIO312 Techniques in Molecular Biology **ECTS 6**

This course covers fundamental molecular biology techniques relevant for genetic applications and study and control of biological systems. It focuses on the study of proteins, their detection, quantification and isolation. Moreover, the course also covers techniques for the study of nucleic acids, including plasmid DNA isolation using different methods, digestion of DNA using restriction enzymes, separation and analysis of nucleic acids using gel electrophoresis, DNA quantification and polymerase chain reaction. *Prerequisite: BIO301.*

BIO313 Chemical Engineering **ECTS 6**

Students are expected to gain basic professional competences in chemical engineering by combining their pre-knowledge in multiple disciplines. This course introduces students to the problem-solving techniques and fundamentals of chemical engineering knowledge. The course covers topics related to fluid mechanics and thermodynamics. In addition, it will show the students how to cope with professional issues regarded to chemical engineering (reactors, biotechnology applications), by using mathematical formulations in chemical applications. *Prerequisite: Junior Standing (108 ECTS)*

BIO314 Neuroanatomy **ECTS 6**

The neuroanatomy course provides a broad overview of the structure and function of the central nervous system, with a principal focus on issues relevant to clinical neurology. Students will learn to identify the major features of the brain and spinal cord and to understand the structural and functional relationships between these structures and to apply this knowledge to the clinical situation. *Prerequisite: Junior Standing (108 ECTS)*

BIO315 Cell and Tissues Culture Engineering **ECTS 6**

This course seeks to equip students with the knowledge on cell culture technology and introduce them to tissue engineering. Cell culture has become one of the major tools used in variety of disciplines of the life sciences today. Topics cover cell culture requirements and equipment, safety and aseptic manipulation, cell types and categories, storage and cell culture sourcing. I also covers methods such as maintaining, sub-culturing, cell quantification and density and contamination assessment. Practical exercises include common assays and protocols used in mammalian cell culture (viability, apoptosis and cell death measurement, proliferation assays). *Prerequisite: Senior Standing (168 ECTS)*

BIO320 Introduction to Forensic Science **ECTS 6**

This course will introduce students to the identification and evaluation of biological evidence in criminal matters using DNA technologies. This includes methods routinely used for the isolation of DNA from cells and techniques applied to DNA quantization, electrophoretic separation, sequence determination, as well as data interpretation, analysis, and reporting. *Prerequisite: Junior Standing (108 ECTS)*

BIO370 Work Placement/Internship[2] **ECTS 6**

[2] IMPORTANT NOTE ON INTERNSHIP/WORK PLACEMENT: The student is expected to: 1. Familiarise himself/herself with the IUS Procedures and Rules for Work Placement/Internship 2. Arrive at work as scheduled, ready to work, and stay for the agreed upon time 3. Present him/herself in a professional manner at all times, including being appropriately dressed for a particular workplace. 4. Communicate any concerns with their supervisor and the internship coordinator in a timely manner and respectfully. 5. Demonstrate enthusiasm and interest in what the company is

An internship experience provides the student with an opportunity to explore career interests while applying knowledge, skills and competences gained in the classroom in a work setting. The experience also helps students gain a clearer sense of what they still need to learn and provides an opportunity to build professional networks. Apart from developing communication skills and gaining practical experience within business environment in the selected field of studies, internship helps students identify skills which need to be further developed, as well as gain better understanding about future career options. *Prerequisite: Junior Standing (108 ECTS)*

BIO401 Biotechnology **ECTS 6**

This course covers the concepts and principles of biotechnology and its various application fields such as medical, agricultural or environmental biotechnology. The potential of biotechnology in the context of sustainable development is also included. The course also gives special emphasis on key scientific discoveries and inventions boosting biotech industry besides to ethical concerns raised around the biotechnology industry. *Prerequisite: Junior Standing (108 ECTS)*

BIO402 Molecular Evolution **ECTS 6**

This course covers theoretical introduction to evolutionary processes that have changed the genetic material over time, considers all different types of genetic mutations. Further, it explains the dynamics of genes in populations and several aspects of evolutionary change at the molecular level; diversity and organization of genomes, focusing of possible factors responsible for genetic changes. In addition, the course aims to correlate molecular techniques, bioinformatics and evolutionary bio-statistics used to understand molecular evolution. *Prerequisite: Senior Standing (168 ECTS)*

BIO403 Plant Pathogenesis **ECTS 6**

This course covers the introduction to plant-microbe associations, types of plant-pathogen interactions, important taxonomic groups of pathogens, major fungal taxa; symbiotic and non-pathogenic associations: life in the rhizosphere, nitrogen fixing organisms, mychorrhizal fungi. It covers plant pathogenesis and the development of disease by defining the symptoms and terminology. Some example of diseases caused by (fungi, bacteria and viruses) will be covered. It explains the mechanisms, chemical and mechanical actions of pathogens, on the physiology of the host. *Prerequisite: Senior Standing (168 ECTS)*.

BIO404 Agricultural Biotechnology **ECTS 6**

This course aims to teach students scientific basis of different issues in agricultural biotechnology. It will help them to understand scientific, ecological and sociological facts of biotechnology in agriculture, food production and marketing. *Prerequisite: Senior Standing (168 ECTS)*.

BIO406 Biomechanics **ECTS 6**

doing; ask questions and take initiative as appropriate. 6. Complete and submit their internship file by designated deadlines. 7. Keep track of and accurately report internship hours worked. (Completion of the work is assigned by the employee. Report of the performed work is also checked by the Program Coordinator at the end of the semester. The internship could be evaluated as ACCEPTED, REJECTED or INCOMPLETE. In order for students to receive 6 ECTS, the internship report needs to be ACCEPTED.)

The purpose of the course is to introduce the foundational concepts for understanding both the laws of mechanics and the typical tissue responses trough the analysis of the musculoskeletal systems using principles of engineering mechanics. Principles of biomechanics are also applied to the design of medical devices and bioengineered tissues. Topics include forces, moments of forces, free body diagrams, principal stresses, transverse shear stresses and beam loading. *Prerequisite: Senior Standing (168 ECTS)*.

BIO407 Protein Engineering **ECTS 6**

The course aims to introduce students to fundamental principles of protein engineering. It starts with the basic review of protein structure, including amino acids, orders of protein structure and structure-function relation. It then covers different types of proteins with specific focus on fibrous proteins, membrane proteins, and enzymes. Later on, it focuses on techniques used to study proteins, including their expression, purification and characterization. Finally, it covers other aspects of protein science like folding, interactions, and determination of 3-D structure. *Prerequisite: Senior Standing (168 ECTS)*

BIO408 Modeling and Simulation of Biomolecular Processes **ECTS 6**

This course serves as an introductory class for modeling of biological processes and systems with a special emphasis on the integration of systems description, model designs and computer code implementation. In includes computational studies based on algorithms that represent physical models of important biological processes and take into account the underlying physics and chemistry of the biomolecular building blocks, both microscopically and macroscopically. Further, it explains Integrated Development Environments to implement and debug computer codes. *Prerequisite: Senior Standing (168 ECTS)*.

BIO409 Immunology **ECTS 6**

This course teaches students fundamentals of immunology with emphasis on biochemical and molecular approaches. The course will be focused on the study of the immune system and its application in medicine and biotechnology. Topics include antigens, B and T cell development, innate and adoptive immunity, genes of the immunoglobulin superfamily, complement, immunological and immunochistochemical assays, and hybridoma technology. *Prerequisite: NS205*

BIO410 Ecology and Environmental Engineering **ECTS 6**

This course seeks to improve the understanding of the flow of energy and materials through ecosystems and the regulation of the distribution and abundance of organisms, explaining the structure and function of populations, communities within ecosystems; comparative habitat ecology and natural selection. In addition, it explains the fundamental principles of micro-cosmology, restoration ecology, solid waste water treatment and the ecological engineering issues in relation to economics and society. *Prerequisite: Junior Standing (108 ECTS)*

BIO411 Mammalian Physiology **ECTS 6**

This course explains the main concepts that are at the core of mammalian anatomy and physiology with a specific focus on humans. Topics include the tissue level of organization, support and movement (integumentary system and muscle), regulation, integration and control of the nervous system and endocrine system. Also, other systems of the body are introduced to students such as cardiovascular, digestive, and urinary systems. *Prerequisite: NS205*.

BIO412 Special Topics in Bioengineering **ECTS 6**

This course covers selected topics in biological and biomedical engineering, delivered by prominent local and regional guest lecturers, experts in one or more of the following areas: biotechnology, genetic engineering, biomedical engineering etc. Through power point presentations and illustrations, they discuss their projects and research topics with the students. *Prerequisite: Senior Standing (168 ECTS)*.

BIO414 Pharmaceutical Biotechnology **ECTS 6**

This course covers major concepts of pharmaceutical biotechnology including preclinical and clinical drug development, biopharmaceuticals, molecular target-based drug development, and employment of DNA-microarrays in the evaluation of novel drug targets. It also focuses on significance of use of microbial synthesis of biological molecules, biopolymers, genomics, proteomics, metabolomics, gene therapy, pharmacogenomics, and personalized medicine. Moreover, regulatory issues related to the biopharmaceutical approval process are also covered, as well as the ethical and social implications of modern biotechnology. *Prerequisite: Senior Standing (168 ECTS)*.

BIO415 Genetic Engineering **ECTS 6**

This course covers the subjects of recombinant DNA technology. The topics are focused on the concepts, methodologies and tools for gene isolation, cloning and manipulation, including application of restriction endonucleases and other DNA modification enzymes, amplification of DNA sequences using the polymerase chain reaction (PCR), detection of DNA using hybridization (Southern blotting, colony screening), properties of cloning vectors and their use in constructing genomic and cDNA libraries, DNA sequencing and sequence analysis, creating and detecting mutations in DNA and introducing these mutations into a genome by specific methods such as homologous recombination in embryonic stem cells. *Prerequisite: Senior Standing (168 ECTS)*.

BIO416 Population Genetics **ECTS 6**

Study of molecular genetic variation in natural populations; effects of selection, inbreeding, random drift, migration, and mutation on DNA and protein polymorphisms; the forces that affect gene frequencies in populations of plants and animals. The course includes both theoretical and empirical studies from the current literature. *Prerequisite: Senior Standing (168 ECTS)*.

BIO417 Molecular Diagnostics **ECTS 6**

This course offers fundamentals of clinical diagnosis and management of disease by molecular biology laboratory methods. Two broad areas will be addressed: molecular diseases/variants; and molecular methods to diagnose and monitor disease. Disorders due to inherited or acquired molecular defects such as errors of metabolism, hemoglobinopathies, leukemia, lymphoma, and cystic fibrosis are discussed. The discussion of molecular approaches to diagnosing and monitoring these diseases will span the conventional methods of PCR, gel electrophoresis and Southern Blotting to Real-time PCR. *Prerequisite: Senior Standing (168 ECTS)*

BIO418 Virology **ECTS 6**

Course about viruses and their host cell - biochemistry and molecular biology of viral infections. Topics include the physical and chemical nature of viruses, methods of cultivation and assay, modes of replication,

characteristics of major viral groups, and the mechanisms of viral disease; emphasis on viral genetics and culture mechanisms. *Prerequisite: Senior Standing (168 ECTS)*

BIO420 Biophysics **ECTS 6**

This course covers the basic notions of thermodynamics, statistical mechanics, and physical kinetics. Specific emphasis is put on molecular interactions, ranging from types of bonds (including covalent bonding, electrostatic and van-der-Waals interactions) to their structural aspect, namely how interactions are combined to produce a complex array of biomolecular structures found in DNA, RNA, and proteins. Prerequisites: Senior Standing. *Prerequisite: Senior Standing (168 ECTS)*

BIO422 Mechanism of Signal Transduction **ECTS 6**

The course explores phenomena of molecular biology of the cell. It introduces general principles of intracellular signaling networks and technical approaches in analysis of key signaling regulatory pathways, cell cycle control mechanisms, apoptosis and biology of cancer occurrence as well as cell birth, linage and death*. Prerequisite: BIO301*

BIO490 Graduation Project **ECTS 6**

The main purpose of the course is to implement a project that will allow students to (preferably) work on a real-world problem. It encourages students work with collogues, and the first part is generally literature review or feasibility analysis, the second part is implementation of the project. It teaches how and where to use many molecular biology techniques, tools and software. It provides a good chance to show students skill to perform real bioengineering related projects. Project topics will be drawn from real-world problems and will be conducted with industry, business, government, and academic partners. *Prerequisite: Senior Standing (168 ECTS)*

C

CS100 Computer Skills **ECTS 3**

The course aims at equipping students with basic computer skills. During this course the students will be taught how to effectively use basic and most common office tools for report writing and presentations, prepare well formatted text documents with tables and graphs, use EXCEL for data entry and simple analysis, spread sheet computations and drawing charts, and prepare presentation file with good formatting and text effects. *No prerequisite.*

CS103 Introduction to Programming **ECTS 6**

This course is designed for students with little or no prior experience in programming. The course introduces the basic concepts of procedural programming. The main goal is for students to develop confidence in programming and the ability to apply programming skills to problems arising in a variety of fields. Topics include: data types, control structures, loops, functions, arrays, files, etc.

CS105 Advanced Programming **ECTS 6**

The course teaches the students main object-oriented concepts such as classes, objects, instance methods, fields, mutator and accessor methods, encapsulation, polymorphism inheritance, etc. It also introduces the fundamental data structures used in computer science such as strings, lists, stacks, queues, etc. During the course, students solve moderately complex real-world problems using object oriented programming language. Students are also able to verify the correctness of their solutions and effectively debug the written software. *Prerequisite: CS103*

CS299 Social, Legal, and Ethical Issues in Computing **ECTS 6**

The course explains and discusses social, legal and ethical aspects of computing in areas such as intellectual property rights, computer and network security, etc. It identifies the effects of technological change, particularly that due to the introduciton of computer and software systems. It provides an understanding of legal areas which are relevant to discipline of computing. It discusses and analyzes real life examples in consideration of ethical matters and solving problems. *No prerequisite.*

CS302 Algorithms and Data Structures **ECTS 6**

The course is designed to teach students the algorithmic toolbox for problem-solving. The main goal of the course is for students to learn the algorithmic paradigms and data structures that enable them to solve computational problems in any field. At the end of the course, a student should be able to take a computational problem from any field and know what data structure and/or algorithm is applicable in that problem. The course develops data structures and relevant algorithms in parallel. Topics include: stacks, queues, arrays, sorting and searching, binary search trees, hashing, heaps, graphs and graph algorithms. *Prerequisites: CS105, MATH204*

CS303 Digital Design **ECTS 6**

This course is an introductory course on building blocks of digital electronics. Students learn the axioms of Boolean algebra, number systems and representation, functionality of logic gates, encoders, decoders, multiplexers, demultiplexers, adders, subtractors, flip-flops etc. The course includes analysis and design of simple finite state machines. Physical implementation of different circuit families is briefly studied as well as architecture of digital memory. Students also learn to implement digital circuits in programmable logic devices using VHDL. *No prerequisite.*

CS304 Computer Architecture **ECTS 6**

Designed to teach students the fundamentals of how computers work. The course gives a broad overview of different layers of computer design, starting from electrical signal and production of digital circuits all the way up to data and program representations. Main three building blocks will be examined: processor, memory, and input/output. The processor section reviews different processor types, computation engines, instruction sets, operand addressing, instruction representation, CPUs and assembly language. In the memory section, the course covers the physical memory, virtual memory and caching. The I/O section covers the bus architecture, I/O devices and buffering. *Prerequisite: CS103*

CS305 Programming Languages **ECTS 6**

The course describes and evaluates the core concepts of programming languages by providing a detailed discussion of design issues of the various language constructs. Design issues and choices for these language constructs are also examined and design alternatives are critically compared for some of the most common programming languages. *Prerequisite: CS105.*

CS306 Database Management **ECTS 6**

The course introduces students to the topics in the field of database management and provides an opportunity to gain theoretical and practical knowledge of the relational algebra and the concepts behind the relational model. Different data modeling concepts are discussed and students are able to demonstrate their skills in the task of database creation using complex SQL queries of relational databases. *Prerequisite: CS105.*

CS307 Operating Systems **ECTS 6**

The course is designed to teach students the concepts of modern operating system design. The focus is on understanding of the major functions of the operating system, emphasizing system programming tasks, dealing with programs and processes, threads, synchronization, input/output, file systems, dynamic memory and inter-process communication. Upon completion of this course, the students will be able to more fully understand the concepts employed in operating systems, explore the use of operating systems such as UNIX, examine issues in distributed operating systems, and practice programming with threads, remote procedure calls and client/server processes. *Prerequisite: CS304.*

CS308 Software Engineering **ECTS 6**

The aims of this course are to show the key elements of software development process as practiced in the industry. It discusses the key ideas in program design, development, debugging, testing and maintenance. Process of planning and writing documentation relevant to the development of software applications are also covered. Topics include software engineering process, UML basics, introduction of design patterns, good coding practices and professional software engineering skills. *Prerequisite: CS105.*

CS309 Advanced Logic Design **ECTS 6**

The course intention is to equip students with the techniques and skills within the area of digital design and to improve their skills of building and documenting work on digital systems by using project oriented approach. *Prerequisite: CS303.*

CS310 Human Computer Interaction **ECTS 6**

Designed to teach students on how computers communicate with people. The course introduces the methodology for designing and testing user interfaces, various interaction styles such as menus, command line, GUIs and virtual reality, interaction techniques (including use of voice, gesture, eye movements), design guidelines, and user interface management system software. At the end of the course, students will have gained a more in-depth understanding of what makes a sleek and usable design, and the effect of a good design on functionality, user satisfaction and productivity. Throughout the course, students will design a small user interface, program a prototype, and test the result for usability. *Prerequisite: CS105.*

CS313 Theory of Computation **ECTS 6**

The course introduces students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability. The students will develop ability to understand and conduct mathematical proofs for computation and algorithms. This theory provides a simple yet elegant way to understand the complex machine known as a computer. The theory is mature, 70 years old, stable and "forever" in contrast with ever-changing technological world and computer systems in particular. Many parts of this theory may have direct impact on practical problems faced by students such as (minimization of) Automata on circuit design, compiler design, and search algorithms; Formal Languages and Grammars on compiler design but also for analysis of natural languages; and Complexity on cryptography and optimization problems in manufacturing, business, and management. *Prerequisites: CS105, MATH204*

CS370 Work Placement/Internship[3] **ECTS 6**

An internship experience in computer sciences provides the student with an opportunity to explore career interests while applying knowledge, skills and competences gained in the classroom in a work setting. The experience also helps students gain a clearer sense of what they still need to learn and provides an opportunity to build professional networks.

CS402 Introduction to Design of Compilers **ECTS 6**

The course is intended to teach the students the basic techniques that underlie the practice of Compiler Construction. The course introduces the theory and tools which can be employed in order to perform syntax-directed translation of a high-level programming language into an executable code. This includes parsing, semantic processing and optimization. The course covers compiler and translator writing techniques and scope rules, block structure and symbol tables, runtime stack management, parameter passing mechanisms, heap storage management, code generation, and macros. A compiler project for a substantial programming language using a compiler generating system is assigned to every student. Students are expected to demonstrate their competences in advanced semantics aspects of programming languages, such as recursion, dynamic memory allocation, types and their inferences, object orientation, concurrency and multi-threading. *Prerequisites: CS105, MATH204.*

CS403 Distributed Systems **ECTS 6**

The course introduces the main principles underlying distributed systems: processes, communication, naming, synchronization, consistency, fault tolerance, and security. Students will be familiar with some of the main paradigms in distributed systems: object-based systems, file systems, web-based and coordination-based systems. On the completion of the unit, students will understand the fundamentals of distributed

[3] IMPORTANT NOTE ON INTERNSHIP/WORK PLACEMENT: The student is expected to: 1. Familiarise himself/herself with the IUS Procedures and Rules for Work Placement/Internship 2. Arrive at work as scheduled, ready to work, and stay for the agreed upon time 3. Present him/herself in a professional manner at all times, including being appropriately dressed for a particular workplace. 4. Communicate any concerns with their supervisor and the internship coordinator in a timely manner and respectfully. 5. Demonstrate enthusiasm and interest in what the company is doing; ask questions and take initiative as appropriate. 6. Complete and submit their internship file by designated deadlines. 7. Keep track of and accurately report internship hours worked. (Completion of the work is assigned by the employee. Report of the performed work is also checked by the Program Coordinator at the end of the semester. The internship could be evaluated as ACCEPTED, REJECTED or INCOMPLETE. In order for students to receive 6 ECTS, the internship report needs to be ACCEPTED.)

computing and be able to design and develop distributed systems and applications. Students will be able to explain what a distributed system is, and what the desired properties of such systems are. They could apply the basic theoretical concepts of distributed systems. They would able to design, implement and analyze the simple distributed system. Student will work on several real world case studies and will have to submit the final project. *Prerequisite: CS307*

CS404 Artificial Intelligence **ECTS 6**

This course is intended to provide students with an opportunity to gain advanced theoretical understanding of history and philosophy of the Artificial Intelligence (AI). Students learn classical AI approaches like search problems, machine learning, constraint satisfaction, graphical models, logic etc. They will also deal with how to model a complex real-world problem by the classical AI approach. *Prerequisite: MATH204*

CS405 Computer Graphics **ECTS 6**

During this course the students learn basic computer graphics algorithms for 3D computer graphics systems. The students are also shown how to identify, define and solve graphics problems through hands-on programming. Topics include: scanline rendering, OpenGl pipeline, triangles, rasterization, transformations, shading, triangle meshes, subdivision, marching cubes, textures, light, color, cameras, displays, tone mapping; BRDF, lighting equation; global illumination, radiosity, ray tracing, antialiasing, reflection, transmission, etc. *Prerequisite: CS302, MATH201*

CS412 Web Application Development **ECTS 6**

The course aims to teach the students to build dynamic web applications. Topics include: PHP scripting language, PHP and MySQL integration, implementation of authentication, web application security issues, session control and other advanced concepts and issues about server-side design strategies. Through labs and programming projects, students will learn how to use current scripting and markup languages to build nontrivial applications. Students also learn HTML, CSS and JavaScript for website design. *Prerequisite: CS105*

CS413 Developing the Interactive Web **ECTS 6**

The aims of the course are to teach the students to develop modern dynamic web applications, as well as to describe the challenges and complexities involved in designing and implementing web applications. Students are provided with hands-on design experience using modern web development tools. Students usually work in teams to develop software programs using major toolkits. *Prerequisite: CS105*

CS414 Computer Vision **ECTS 6**

Image acquisition, image representation, image processing, image segmentation, color image processing, morphological operations, object recognition, feature extraction, representation and description, pattern recognition and training. *Prerequisite: CS103, MATH201*

CS415 Pattern Recognition **ECTS 6**

This course offers the algorithms, methodologies and skills of statistical pattern recognition from a variety of perspectives. Topics including Bayesian Decision Theory, Estimation Theory, Linear Discrimination Functions, Nonparametric Techniques, Support Vector Machines, Neural Networks, Decision Trees, and Clustering Algorithms etc. will be discussed. Students will understand basic concepts in pattern recognition, gain

knowledge about state-of-the-art algorithms used in pattern recognition research, understand pattern recognition theories, such as Bayes classifier, linear discriminant analysis and apply pattern recognition techniques in practical problems. *Prerequisite: MATH201*

CS416 Cryptography **ECTS 6**

Students learn theoretical foundations and practical applications of cryptography. The goal of the course is to have students understood how cryptographic algorithms, keys and protocols, an appropriate hardware and software can solve security problems such as confidentiality, integrity and authenticity. Topics include: threats, attacks, and countermeasures, including cryptosystems and cryptographic protocols, secure systems/networks, history of cryptography, encryption (conventional, public key), digital signatures, hash functions, message authentication codes, identification, authentication, and applications. *Prerequisites: CS302, MATH204*

CS417 Introduction to Data Mining **ECTS 6**

The aims of this course are to presents to student's well-known data mining techniques and their application areas. Specifically, the course demonstrates basic concepts, principals and methods of data mining. It also demonstrates the process of KDD and presents a review of available tools. Students will deal with data issues that will be need for successful application of data mining, understand statistical logic of data mining algorithms, apply knowledge in database technologies which is necessary in data mining apps, apply pre-processing, transformation and interpretation methods for given data and apply clustering, association rules and classification algorithms. *Prerequisite: CS302*

CS420 Network Programming **ECTS 6**

This course covers principles and practice of network programming, application layer protocol and how applications use the transport layer, the client-server model, concurrent processing, introduction to sockets and related functions client and server software design with examples, principles, issues and challenges in e-mail and web application protocols, security protocols and network life system concepts. *Prerequisites: CS105, SE308*

CS421 Management Systems **ECTS 6**

This course introduces the main techniques for database analysis and design and how they can be applied in a practical way. Additionally, it covers a methodology for database design and considers the main technologies associated with data ownership, data security and how to deal with big data like data warehouses. *Prerequisite: CS306*

CS422 Wireless Mobile Networks **ECTS 6**

The course will cover basic aspects of signal propagation like path loss of signals, multi-path propagation, interference, multiplexing, spread spectrum, media access control, wireless system design, wireless link characteristic, avoiding collision, various types of wireless technologies (Bluetooth, IrDA, Wi-Fi, WiMax), reactive and proactive routing, cognitive networks, ad hoc networks and other topics. *Prerequisites SE308*

CS423 Parallel Computing **ECTS 6**

The course is designed to teach students the main tenets of parallel computing. The goal of the course is to have students learn about parallel and high-performance computers and algorithmic design paradigms that surround such architectures. Topics include: parallel architectures design, embeddings, routing, parallel performance metrics, parallel sorting, parallel matrix operations, graph problems, dynamic load balancing, types of parallelisms, parallel programming paradigms, message passing programming in MPI. *Prerequisites: CS302, CS307*

CS426 Software Engineering II **ECTS 6**

During the course the students learn how to develop a strong sense of design quality, understand the process of design through examples, discussion and introspection. Students also develop advanced skills for specification, design, implementation and testing of software. Topics include software testing, software maturity models, cost specification models, distinction between critical and non-critical systems, bug estimation, software reliability models, software complexity, quality control, etc. During the course, students are expected to work on a hands-on, real life project that includes the full life cycle of software development. *Prerequisite: CS308*

CS427 Computer and Network Security **ECTS 6**

This course provides students to learn the basic concepts in computer security containing software vulnerability analysis and defense, networking and wireless security, applied cryptography, as well as legal, ethical, social and financial sides of security. Students will also learn the necessary methodology for how to scheme and analyze security critical systems. *Prerequisites: CS307, SE308*

CS498 Special Topics in Computer Science I **ECTS 6**

Special Topics in Computer Science I content is highly specialized to various sub-fields of computer science. The topics may include but are not limited to: mobile application development, automated language processing, high performance computing systems, new trends in game development, etc. Students are encouraged to consult current curriculum and syllabus version. *No prerequisite.*

CS499 Special Topics in Computer Science II **ECTS 6**

Special Topics in Computer Science II content is highly specialized to various sub-fields of computer science. The topics may include but are not limited to: mobile application development, automated language processing, high performance computing systems, new trends in game development, etc. Students are encouraged to consult current curriculum and syllabus version. *No prerequisite.*

E

EE201 Analog Electronics I **ECTS 6**

The course covers material classification based on the energy diagrams: n-type and p-type extrinsic materials, diode biasing, diode characteristics, operation of the diode, operation of special purpose diodes, analysis of different diode circuit configurations, analysis and design of basic bipolar junction transistors and their circuits, analysis and design of basic field effect transistors and their circuits. *Prerequisite: ENS203.*

EE202 Electrical Circuits II **ECTS 6**

The course deals with; AC circuits analysis techniques; power in AC circuits, poly-phase circuits, Laplace transform and its application in electrical circuits, Frequency dependent circuits, mathematical models and differential equations of AC circuits and various software tools for analysis of AC circuits. *Prerequisite: ENS203.*

EE221 Object Oriented Programming **ECTS 6**

The course aims to equip students with knowledge of the principles which are underpinning object oriented programming. After successful completion of the course the students should be able to apply principles of OOP to programming problems and demonstrate understanding of C++ standard library. Students should be able to use OOP methodology to document and implement solutions to programming problems, use syntax, language features such as templates and forms of casting, conversions and model real-life problems to software solutions. *Prerequisites: ENS213 or CS103.*

EE301 Analog Electronics II **ECTS 6**

The course aim is to equip students with working knowledge of operational amplifiers and their applications, their frequency response and achieve competency in the use of computer aided design tools for op-amp circuitry modeling, analysis, and design. During this course students are expected to gain skills to analyze analog circuits containing active components - operational amplifiers - with respect to gain and stability, to design various simple active LP and HP filters that incorporate operational amplifiers, Use simulation software for analog devices, Formulate their lab findings in a report. *Prerequisite: EE201.*

EE305 Instrumentation and Measurements **ECTS 6**

Basic measurement concepts, basic electronic measurement, signal generators and analyzers, sensors, digital instruments, acquisition systems and optical measurements. *Prerequisite: ENS203.*

EE309 Introduction to Optimization **ECTS 6**

This course introduces students to applications and algorithms for linear, network, integer, and non-linear optimization. Students will study primal and dual simplex methods, network flow algorithms, branch and bound, interior point methods, Newton and quasi-Newton methods, and heuristic methods. Students will be equipped with skills and competences in implementing algorithms using MATLAB. *Prerequisite: MATH202.*

EE311 Control System Design **ECTS 6**

The course introduces students to the concept of state-space descriptions of dynamic systems. Student learn about the following concepts: Relations to frequency domain descriptions; State-Space realizations and canonical forms; Stability; Controllability and Observability; Minimal realization, Response shaping, Observers. *Prerequisite: ENS206.*

EE321 Electrical Machines **ECTS 6**

The course provides a deep look to electrical machines and the major physical principles that govern them. The course reviews basic principles of phasor analysis, three phase circuits, Ideal and practical transformers. The course studies AC machinery fundamentals and DC machinery fundamentals. Detailed look to

synchronous machines and induction motors is presented. Finally, and introduction to power electronics and machine drive is provided. *Prerequisite: EE202*

EE322 Power Systems **ECTS 6**

The course aims are to: - Introduce the students to basic power systems concepts like per unit, polyphase systems, transmission lines, transformers, admittance, impedance and others. - Introduce the students to models of various power system components - Provide the students with hands-on skills in power system related calculations - Introduce the students to the transient and steady state analysis of transmission lines - Provide the students opportunities to write substantial, professional, technical reports and conclusions. *Prerequisite: EE202*

EE323 Illumination Techniques **ECTS 6**

The course covers the technologies used in illuminated environments. Students learn the pros and cons of different hardware options for various lighting applications and electrical requirements of different lighting technologies. This course also includes calculation techniques for predicting the illumination in spaces from lighting products. *No prerequisite.*

EE325 Embedded Systems **ECTS 6**

The course covers embedded systems from software and hardware perspectives. Students gain real life coding experience through programming in open source platform. Students learn how to explain various types of peripherals and communication protocols, design and implement small-scale embedded systems, and write C and C++ language code for embedded systems. *Prerequisite: ENS213 or CS103*

EE331 Introduction to Communication Systems **ECTS 6**

The course covers principles in modern communication systems. The course aims to provide students with in-depth understanding of implementation considerations related to the systems of data communication. Students learn how to describe the layered organization and structuring of computer networks, identify and analyze the key design parameters and their effect to provide consistent services in computer networks, analyze the key problems involved at the layers of the TCP/IP protocol stack and apply the techniques and algorithms that have been devised to address these problems. *Prerequisite: ENS211*

EE332 Electromagnetism II **ECTS 6**

The course examines terms, laws and methods related to electromagnetic waves. Students learn Maxwell`s Equations the wave propagation in lossy and lossless media. Students will gain skills to calculate the basic electromagnetic parameters via simulation software, as well as to design, simulate and build a microwave device. Finally, students learn how to make a presentation of designed device and write a conference paper. *Prerequisite: ENS201.*

EE334 Information and Coding Theory **ECTS 6**

The course aims at equipping the students with basic properties of communication as well as with coding of information transmitted through communication channel. The students will be able to apply the basic coding techniques using MATLAB. *Prerequisite: ENS211*

EE370 Work Placement/Internship[4] **ECTS 6**

A work placement/ internship experience provides the student with an opportunity to explore career interests while applying knowledge and skills learned in the classroom in a work setting. The experience also helps students gain a clearer sense of what they still need to learn and provides an opportunity to build professional networks. *Prerequisite: Junior Standing (108 ECTS).*

EE403 Industrial Process Instrumentation **ECTS 6**

This course is designed to equip students with competences to read and produce industrial process documentation. Students improve their skills to design and configure systems and choose components for industrial process control by using project oriented approach. *Prerequisite: EE305*

EE412 Motion Control System **ECTS 6**

This course is intended to teach students advanced concepts in mechanical motion control. The emphasis will be put on applied concepts and generic solutions in the motion control like: disturbance rejection, robustness, compensation of nonidealities. The concepts will discuss in the framework of SISO (1 dof systems) and MIMO systems like robotic manipulators and mobile robots. The systems with flexible joints and flexible links will be discussed. *Prerequisite: ENS206*

EE418 Introduction to Machine Learning **ECTS 6**

This course covers popular topics in the field of machine learning, those include: supervised learning algorithms including linear regression, logistic regression, decision trees, k-nearest neighbor, an introduction to Bayesian learning and the naïve Bayes algorithm, support vector machines and kernels and neural networks with an introduction to Deep Learning. Other topics in the field will be covered as time allows, those include, clustering, feature reduction and feature extraction and different statistical testing and validation methods. The course will be accompanied by hands-on problem solving with programming (some open source programming environment or MATLAB). *No prerequisite*

[4] IMPORTANT NOTE ON INTERNSHIP/WORK PLACEMENT: The student is expected to: 1. Familiarise himself/herself with the IUS Procedures and Rules for Work Placement/Internship 2. Arrive at work as scheduled, ready to work, and stay for the agreed upon time 3. Present him/herself in a professional manner at all times, including being appropriately dressed for a particular workplace. 4. Communicate any concerns with their supervisor and the internship coordinator in a timely manner and respectfully. 5. Demonstrate enthusiasm and interest in what the company is doing; ask questions and take initiative as appropriate. 6. Complete and submit their internship file by designated deadlines. 7. Keep track of and accurately report internship hours worked. (Completion of the work is assigned by the employee. Report of the performed work is also checked by the Program Coordinator at the end of the semester. The internship could be evaluated as ACCEPTED, REJECTED or INCOMPLETE. In order for students to receive 6 ECTS, the internship report needs to be ACCEPTED.)

EE422 Power Electronics **ECTS 6**

This course will introduce students to the fundamental analysis of the switching power converters and their control. The course will include: semiconductor switches and their realizations, DC-to-DC, DC-to-AC and AC-to-DC conversions, dynamics, averaging and control of switching converters, basic magnetic circuits. The Case study of switching power converter design will be also introduced. The laboratory assignment will enable students to design and build converter to satisfy the specs. *Prerequisite: EE301.*

EE423 High Voltage Engineering **ECTS 6**

This course covers generation and transmission of electric energy, generation of high voltages, measurement of high voltages, electrical breakdown in gases, breakdown in solid and liquid dielectrics. Students learn nondestructive insulation test techniques, over voltages, testing procedures and insulation coordination. *Prerequisite: EE322.*

EE424 Electrical Power Transmission and Distribution **ECTS 6**

This course covers topics related to the system of transmission and distribution of electrical power what is commonly called “the grid.” Students learn how bulk electricity moves from the generation sites over long distances to substations closer to areas of demand for electricity. They gain knowledge on transmission lines, transformers, substations and other equipment which have voltages of 100 kV and above. They also learn how to reduce lower voltage by electricity distributors before it can be delivered to a residence or business. *Prerequisite: EE322.*

EE429 Digital Power Systems Protection **ECTS 6**

The course aims to provide students with introduction to fuse and over current protection, introduction to fundamental principles of distance relaying, differential protection, the role current and voltage transformers in power system protection. Students gain hands-on skills with SIPROTEC 5 relays and digsi 5 software for digital protection in power systems. *Prerequisite: EE322*.

EE430 Control of Electrical Drivers **ECTS 6**

This course covers topics in electrical drives control systems. The emphasis will be put on applied concepts and generic solutions in the drives control for DC and AC electrical drives. The concepts will be discussed in the framework of SISO and MIMO systems. *Prerequisite: EE321*

EE431 Digital Signal Processing **ECTS 6**

The course covers concepts and methods of DSP. It deals with discrete signals and systems, and their applications. The course covers discrete-time convolution, difference equations, the z-transform and the discrete Fourier transform, and designing both recursive and non-recursive digital filters. Students learn use of MATLAB and Simulink as an essential part of the course. *Prerequisite: ENS211*

EE432 Wireless and Mobile Communications **ECTS 6**

Students learn pros and cons of wireless communication technologies. At the end of the course, students should be able to select a wireless technology or a combination of technologies to suit a given application. *No prerequisite.*

EE433 Microwave Engineering **ECTS 6**

The course covers the application of modern network principles to wave-guiding systems. Students learn about impedance transformation and matching, scattering matrix, propagation in non-isotropic media, passive microwave devices, electromagnetic resonators, and measurements in microwave systems. *Prerequisite: ENS201.*

EE434 Digital Communications **ECTS 6**

The students learn about practical integration of optical fibre, radio frequency (RF)/microwave, antenna and optical wireless, including Light Fidelity (Lifi) systems**.** *Prerequisite: EE331*

EE435 Microprocessors I **ECTS 6**

The course aims to provide students with understanding of basic computer organization and microprocessor architecture. The course covers an introduction to the assembly language programming. Students learn about various interfacing of devices and ports with microprocessor and microcontrollers. *Prerequisite: CS303*

EE436 Programmable Logic Controllers **ECTS 6**

The course gives an introduction to Programmable logic controllers; their structure, their connection, and their various types of input and output devices and signals. The course gives an introduction different programming approaches and different programming platforms, with more emphasis on ladder diagram programming using logix pro as well as zelio soft. Topics include counters, timers, comparators, Control Instructions, data manipulation as well as input and output devices. *Prerequisite: CS303*

EE437 Introduction to Robotics **ECTS 6**

This course is intended to present fundamentals of robotic systems. Specific subjects include: position and orientation in 3-D space; manipulator forward and inverse kinematics; velocities and forces - Jacobian's relations; manipulator dynamics; stiffness and compliance control; trajectory control; mobile robots - selected topics. A team project will emphasize the variety of robotics systems. *Prerequisite: Senior Standing (168 ECTS).*

EE439 Optimal Filtering **ECTS 6**

This course gives thorough knowledge of linear estimation theory. The main theme of the course is optimal linear estimation, Kalman and Weiner filtering, which are systematic methods to solve estimation problems with applications in several technical disciplines, for example in telecommunications, automatic control and signal processing but also in other disciplines, such as econometrics and statistics. The course also provides an introduction to optimal filtering for non-linear systems. The course assumes familiarity with basic concepts from matrix theory, stochastic processes, and linear systems theory. The course is directed towards the students who intend to work with development and research within these fields. Prerequisite: MATH201

EE440 Microprocessors II **ECTS 6**

This course provides students the understanding and programming techniques for advanced microprocessors/controllers. Topics discussed include CPU organization, instruction set formats, addressing modes, real-time operating systems, task control blocks, message passing, semaphores, mailboxes, memory and I/O interfacing, resource and memory management. Includes techniques for developing software and

hardware for microprocessor-based systems, computer aided design using a multistation logic development system, use of components commonly found in microprocessor-based systems. The aim is to investigate various metrics for evaluating such systems, including performance, power, energy, and code density. *Prerequisite: EE435*

EE442 Antennas and Wave Propagation **ECTS 6**

This course provides foundations of theory and practice of modern antennas. It covers theoretical background, antenna parameters, simple radiators, antenna array theory, wire antennas, broadband antennas, microstrip antennas, aperture radiators, base station antennas, antennas for mobile communications, antenna measurements. *Prerequisite: ENS201*

EE446 Satellite Systems and Communications **ECTS 6**

This course covers the most relevant aspects of satellite communications, with emphasis on the most recent applications and developments. The course begins with a review on the background and basic concepts of satellite communications, such as orbital aspect and frequency assignments and propagation aspects that affect the satellite. Students gain competences in design of a digital satellite link, including link budgets, modulation, error control coding, baseband signalling theory, and multiple access methods. Antennas and earth station technology is presented, including the design of very small aperture terminals (VSATs). The course also covers non-geosynchronous orbits and their applications. Specific applications of satellites are also explored, including the global positioning system (GPS), satellites for mobile communication, and satellite for internet. *No prerequisite*

EE451 Power System Stability **ECTS 6**

The course aims to provide advanced knowledge about stability problems and dynamic mechanisms in electric power systems. This will give specialized insight and understanding of the theoretical foundations behind the physical phenomena that are necessary for modelling and control of power systems. After the course the student shall have gained skills to perform independent analysis and controller design for power systems based on state-of-the-art computer based methods and tools for dynamic analysis. A group project work running through most of the semester is a major part of the home work to ensure a research based approach and problem based learning of the curriculum. MATLAB and DIgSILENT/PowerFactory are used as tools for modelling and simulation of various aspects of power system stability phenomena. The students work in groups of 2-3. The project is being graded and together with the written exam for the final evaluation. *Prerequisite: EE435*

EE453 Power System Control and Optimization **ECTS 6**

Aim of this lecture is the presentation of methods for control and optimization in power systems. It covers all levels of automatic power system control starting with short-term relay control and ending with long-term power system optimization. Different optimization and control methods being used on all levels of power system automation are introduced. Energy transfer in power systems; real and reactive power flows; VAR compensation. Power system control, interconnected operation. Power system stability, techniques of numerical integration. Load representation, power quality. Computational paradigms for typical power system problems. Computer simulation of representative power system problems. This course uses Matlab/Simulink in the exercises for simulations, stability analysis, control design and optimization. In addition to the exercises students are going to work on small application projects. *Prerequisite: EE322.*

EE454 Electrical Power Generation **ECTS 6**

This is an introductory course in electrical power generation that examines various types of renewable energy sources. While examining many developing technologies, the course concentrates on the design and application of photovoltaic and wind electrical generation. It examines conventional synchronous and induction machines, as well as modem doubly-fed induction machines and their application in wind generation. It also provides an introduction to inverter technology and methods of interfacing renewable energy power plants with the electrical power grid. *Prerequisite: EE321*

ENS105 The Brain **ECTS 6**

This is an introductory course to present students the fundamental knowledge about brain structure and function in the context described above. First, the human nature will be discussed as a product of human genome which controls the organization of brain together with interaction with the environment. Some preliminary knowledge about DNA, cells and their functions will be incorporated before presenting students some introductory level of brain anatomy and function. University elective course. *No prerequisite*

ENS201 Electromagnetism I **ECTS 6**

This course is a fundamental course in electromagnetism for any future academic and professional work in this area. It covers topics such as: review of vector analysis, electrostatics, electric potential, electric fields in matter, magnetostatics, magnetic fields in matter, electrodynamics, Maxwell's Equations Students are expected to develop skills in practical solutions to various electromagnetic problems, to gain competences in vector algebra, differential calculus, and their applications in the field of electromagnetic, To understand electromagnetic properties of different materials, to become comfortable in the terminology used in electromagnetism. *Prerequisite: MATH101*

ENS202 Thermodynamics **ETCS 6**

The course introduces basic concepts and principles of thermodynamics. Students look at different systems, from household appliances to live organisms, through a prism of thermodynamics laws. Concept of energy, work and entropy is explained by analyzing different system that surround us. Throughout the course students apply the ideal-gas equation of state in the solution of typical problems. solve energy balance problems for closed (fixed mass) systems that involve heat and work interactions for general pure substances, ideal gases, and incompressible substances, apply the steady-flow energy equation or the First Law of Thermodynamics to a system of thermodynamic components (heaters, coolers, pumps, turbines, pistons, etc.) to estimate required balances of heat, work and energy flow, apply the second law of thermodynamics to cycles and cyclic devices and calculate the entropy changes that take place during processes for pure substances, incompressible substances, and ideal gases. *Prerequisite: MATH102, NS102*

ENS203 Electrical Circuits I **ECTS 6**

This course intends to introduce the students to the principles of electric circuits and various DC circuits solution methods and software. Introduce the students to the basic AC circuits and mathematical representation of AC circuits. Provide the students with hands-on skills in the laboratory. Provide the students opportunities to write substantial, professional, technical reports and conclusions. *Prerequisite: MATH101*

ENS205 Materials Science **ECTS 6**

The course aims to introduce basic concepts and principles of materials science encountered in engineering practice. The course focuses on the following topics: Atomic Structure, Atomic and Ionic Arrangements, Crystalline Structure & Defects, Crystalline Structure & Defect, Diffusion, Mechanical Properties of Materials, Strain Hardening and Annealing, Principles of Solidification, Phase Transformation and Phase Diagrams, Ceramic Materials, Polymers, Composites, Construction Materials, Thermal Properties of Materials, Corrosion and Wear. *No prerequisite*

ENS206 System Modeling **ECTS 6**

The aims of this course are to familiarize students with the concept of modeling, analysis, and control of electrical, mechanical, and electromechanical systems with realistic steady-state and transient specifications; system description using transfer functions and main components of a closed loop control system including PID regulator. Students learn how to determine the system stability using mathematical and graphical tools. *Prerequisite: MATH202*

ENS207 Engineering Graphics **ECTS 6**

Engineering Graphics course aims at comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views (principal, auxiliary, sections), dimension and annotate two-dimensional engineering drawings, application of industry standards and best practices applied in engineering graphics. The course emphasizes freehand sketching to aid in the visualization process and to efficiently communicate ideas graphically. It also introduces CAD software for the creation of 3D models and 2D engineering drawings. *No prerequisite*

ENS208 Introduction to Manufacturing Systems **ECTS 6**

Introduction to Manufacturing Systems is introducing most used manufacturing processes to students and it gives practical training for some of manufacturing technologies such as 3D printing, drilling and cutting on CNC machines. The course is focusing on the following topics Materials in manufacturing and manufacturing processes, Forming and shaping processes, Joining Processes and Applications, Metal casting processes and principles, Machining processes and machine tools, 3D modelling with SolidWorks, 3D printering, Creating a CAD model for transfer to a CNC machine, Machining the model using a CNC machine. *Prerequisite: MATH101*

ENS209 Statics **ECTS 6**

The course aims at providing students with a basic understanding of forces and force systems acting and equilibrium conditions for particle or rigid body. Students learn to perform analysis of forces developed in structural members. Students also gain skills how to perform structural analysis similar to those they will encounter in industry. *Prerequisite MATH101*

ENS210 Computational Biology **ECTS 6**

This course aims to introduce students to major issues concerning analysis of genomes, sequence and structures. Various existing computational approaches are critically described and the strengths and limitations of each are discussed. More specifically, topics covered include biological databases, analysis of nucleic acid and protein sequences, protein structure prediction, and others. The course is recommended for

both molecular biologists and computer scientists desiring to understand the major issues concerning representation and analysis of genomes, sequences and proteins. *Prerequisite: ENS213*

ENS211 Signals and Systems **ECTS 6**

The course seeks to equip students with knowledge on the continuous and discrete time signals, and the analysis of both in time and frequency domains. Students are required to demonstrate their understanding of the fundamental properties of linear systems, by explaining the properties to others. Use linear systems tools, especially transform analysis and convolution, to analyze and predict the behavior of signals and linear systems as a whole C17. *Prerequisite: MATH102*

ENS213 Programming for Engineers **ECTS 6**

The course aims to introduce programming concepts and techniques with C++ language syntax and MATLAB. It presents; control statements, loops, functions, arrays and pointers. It also aims to examine writing programs for a wide variety of problems in math, science, finances, and games. *No prerequisite.*

ENS221 Introduction to Engineering – To rephrase **ECTS 6**

The course aims firstly to introduce students to a range of engineering disciplines and the engineering methods of problem-solving. Moreover, to motivate the students toward future engineering careers and to develop skills on improving core engineering communication skills. Finally, to introduce general engineering computation software (SciLab, Macsyma, GNU Octave, Sage, R, PSPP, etc.) *No prerequisite.*

ENS302 Engineering Optics – To check **ECTS 6**

Students learn how to design optical systems with simple graphical techniques, and then transform those pencil and paper designs to include real optical components including lenses, diffraction gratings and prisms. Students learn how to enter these designes into an industry-standard design tool, analyze and improve performance with powerful optical system specification, optimize optical systems and optical design. *Prerequisite: NS102*

ENS400 Bioentrepreneurship **ECTS 6**

The main purpose of this course is to provide students the preliminary competences in entrepreneurship in the field of life sciences. The course is to encourage students identify business opportunities in the life science sector and further develop their business idea. *No prerequisite*

ENS490 Graduation Project **ECTS 6**

This is a capstone project course that will allow students to test their skills on a real world problems. It is typically a team work up to 3 members. The aim is to help students to select related project topics and get the project completed in an efficient way, through: guiding them in searching reliable literature, preparing and presenting results, and writing the reports. Students are expected to develop capability to work

independently with a problem-solving orientation. After successful completion of the course students should be able to demonstrate adequate knowledge to proceed with their studies at the graduate level. Students are expected to apply relevant ethical concepts during the course of the project. Professional-quality written reports and presentations covering all aspects and phases of an engineering project are expected.

I

IE301 Production Planning I **ECTS 6**

This course equips students with knowledge of fundamental issues in production and inventory planning and control in manufacturing firms, at the same time, developing the students' modeling and analytical skills. The course is targeted toward engineering students planning careers in technical consulting, business analysis in operations, logistics and supply-chain, positions in general management and future entrepreneurs. The students will be able to apply the techniques using MS EXCEL. *Prerequisite: MATH203*

IE302 Production Planning II **ECTS 6**

Course aim is to equip students with more advanced knowledge of production planning. Topics include: models with linear costs, smoothing problems, multi-product and multistage models, operations scheduling, single machine, multiple machine models, stochastic scheduling; Material Requirements Planning, pull and push production control systems, JIT concept, Facility layout and location. *Prerequisite: IE301.*

IE303 Operations Research I **ECTS 6**

Operations research (OR) have many applications in science, engineering, economics, and industry. The ability to solve OR problems is crucial for both researchers and practitioners. Being able to solve the real life problems and obtaining the right solution requires understanding and modeling the problem correctly and applying appropriate optimization tools and skills to solve the mathematical model. The goal of this course is to teach you to formulate, analyze, and solve mathematical models that represent real-world problems. We will also discuss how to use spreadsheets and other software packages for solving optimization problems. *Prerequisite: MATH201*

IE304 Operations Research II **ECTS 6**

To improve the knowledge of OR delivered in OR I and to analyze industrial engineering problems such as: Integer programming, travelling salesman problem, deterministic dynamic programming, network models, shortest route problem, maximal flow models, CPM and PERT, Goal Programming: Methods . *Prerequisite: IE303.*

IE305 Work Analysis and Design **ECTS 6**

Students are expected to gain competences in work and working environment analysis. The course covers topics such as: methods design analysis techniques, evaluation and appraisal; work measurement procedures, efficiency, productivity concepts, equipment design and its effect on human performance, manual work, worker-machine systems, automation; assembly lines, line balancing; introduction to logistics operations, and production versus service systems. *Prerequisite: Junior standing (110 ECTS)*

IE306 Simulation **ECTS 6**

The objective of the course is to present the concepts and methods of simulations to the point where the student is able to carry out effective simulation modeling, analysis and projects. Topics covered in this course are: modeling and computer simulations, history of simulations, fundamental simulation concepts, entities, attributes, resources, Queues, Event-driven simulation, Randomness in Simulations, Simulations

with Spreadsheets, Basics of Arena, Animations within Arena, Finding and fixing errors, Modeling detailed operations, Statistical Analysis of Output, Steady-state statistical analysis, Entity transfer, Area Integration and Customization, Continues and Combined Discrete/Continues models, Conducting simulation studies. *Prerequisite: MATH203*

IE307 Quality and Reliability Engineering **ECTS 6**

This course covers competition and quality concepts, history of quality, quality gurus in industrial engineering discipline. During the course basic concepts of Quality and Reliability Engineering such as philosophy and principles of TQM, quality culture in companies, and responsibilities in activities, continuous improvement (kaizen) are discussed. Based on this knowledge, students are expected to calculate Quality costs. Quality and Reliability Engineering and its applications in production life are to understand the suppliers in TQM, EFQM excellence model, self-assessment, and TS-EN-ISO 9000 standards. *Prerequisite: MATH306*

IE309 Ergonomics **ECTS 6**

Students learn to recognize, evaluate, and control work place conditions that cause or contribute to employee safety and productivity issues. They will be able to understand and define components of ergonomics; work physiology; anthropometry; musculoskeletal disorders; common risk factors such as vibration, temperature, material handling, repetition, and lifting; computer workstations; elements of an ergonomic program; and developing the business case for ergonomic improvements. Course emphasis is on office and foundry "shop floor" examples, covering analysis and design of workstations, equipment and workflow. *Prerequisite: Junior standing (110 ECTS)*

IE318 Engineering Economics **ECTS 6**

The course covers the principles of engineering economics and cost analysis. Students learn economic analysis methodologies relevant to systems engineering. Topics covered in this course are inter alia: Time Value of Money, Time Value of Money (TVM) Net Present Value (NPV) Analysis, Equivalence, MARR Measures of Merit, The Cost of Capital, Comparison of Alternatives, Inflation, Replacement Analysis, Cost Estimation I, Cost Estimation II, Risk and Uncertainty Analysis I, Multi-Criteria Decision Analysis. *Prerequisite: Junior standing (110 ECTS)*

IE370 Work Placement/Internship (at least 25 days)[5] **ECTS 6**

An internship experience provides the student with an opportunity to explore career interests while applying knowledge, skills and competences gained in the classroom in a work setting. The experience also helps

[5] **IMPORTANT NOTE ON INTERNSHIP/ WORK PLACEMENT:** The student is expected to: 1. Familiarise himself/herself with the IUS Procedures and Rules for Work Placement/Internship 2. Arrive at work as scheduled, ready to work, and stay for the agreed upon time 3. Present him/herself in a professional manner at all times, including being appropriately dressed for a particular workplace. 4. Communicate any concerns with their supervisor and the internship coordinator in a timely manner and respectfully. 5. Demonstrate enthusiasm and interest in what the company is doing; ask questions and take initiative as appropriate. 6. Complete and submit their internship file by designated deadlines. 7. Keep track of and accurately report internship hours worked. (Completion of the work is assigned by the employee. Report of the performed work is also checked by the Program Coordinator at the end of the semester. The internship could be evaluated as ACCEPTED, REJECTED or INCOMPLETE. In order for students to receive 6 ECTS, the internship report needs to be ACCEPTED.)

students gain a clearer sense of what they still need to learn and provides an opportunity to build professional networks.

IE401 Manufacturing Processes **ECTS 6**

This course provides students an overview of modern manufacturing technology and introduces them to manufacturing processes, inspection methods and quality. Introduce them with various conventional and non-conventional manufacturing processes and their applications in industry: casting, metal forming, forging, extrusion, rolling, joining and welding, EDM, ECM, laser machining, abrasive flow processes. *Prerequisite: Senior standing (165 ECTS)*

IE402 Integrated Manufacturing **ECTS 6**

This course equips students with competences needed to use methods and practices in industrial design, prototyping, and manufacturing. Introduce them with investigation of the product design process, automated transfer lines, automated assembly lines, assembly line balancing, flexible manufacturing systems, automated material handling, general scheduling theory and shop floor control. *Prerequisite: Senior standing (165 ECTS)*

IE404 Logistics **ECTS 6**

This course equips students with knowledge of strategic importance of good supply chain management and logistics design, planning and operations for every firm. Students learn main components of supply chain, how to apply fit and scope strategy, how to design distribution networks, applications of e-business and analytics of uncertain environment. *Prerequisite: Senior standing (165 ECTS)*

IE405 Decision Analysis **ECTS 6**

Students learn to make decisions strategically, structure objectives, develop alternatives, perform multi-objective value analysis, think about uncertainty and make decisions with uncertainty factor, combine multiple objectives and uncertainty, and decide on resource allocation. Students learn how to use descriptive statistical techniques, tools and statistics software; state, test and interpret hypotheses about parameters of common population models; apply regression and correlation analysis techniques correctly using popular software. Students are expected to be able to write a report about findings that will clearly/visually explain the results, attach all relevant output, and guide decision maker. *Prerequisite: Senior standing (165 ECTS)*

IE406 Financial Analysis **ECTS 6**

This course covers quantifying alternatives for easier decision-making., Students learn how to compare alternative proposals, and explain the main terms in finance such as benefit-cost analysis, project investments, depreciation, inflation. *Prerequisite: Senior standing (165 ECTS)*

IE407 Management Information Systems **ECTS 6**

The focus of the course is on the key concepts, models, and methods that enable managers to effectively manage the development and utilization of technologies. The goal is to develop an awareness of the range, scope, and complexity of the phenomena, issues, and problems related to economics and management of technology and technological innovations. The course will enable the integration of technology, operations

and business strategy. In short, the participants will develop a better understanding of the complex issues surrounding the managerial tasks with respect to technology. *Prerequisite: Senior standing (165 ECTS)*

IE408 Project Management **ECTS 6**

This course introduces project management issues and techniques. The course challenges students to apply the theoretical knowledge to real-world projects. Project selecting, structuring, scheduling, budgeting, resource management and project control are the main topics. *Prerequisite: Senior standing (165 ECTS)*

IE409 Reliability Analysis **ECTS 6**

The focus of the course is on the key concepts of components and system reliability; design and assessment of engineering systems and processes for assuring reliability of performance; life distributions; life testing procedures; estimating system reliability; maintenance and replacement models; data collection, storage and analysis for maintenance; computerized maintenance systems; total productive maintenance. *Prerequisite: Senior standing (165 ECTS)*

IE410 Design of Experiments **ECTS 6**

To provide the theoretical and applied framework needed to plan, design and conduct experiments, and analyze the results to obtain objective conclusions. Students will use standard statistical software packages for analyses (Excel, Stata, SPSS, etc). *Prerequisite: Senior standing (165 ECTS)*

IE411 Forecasting **ECTS 6**

The focus of the course is on to introduce students with the main terms in forecasting such as : Simple and multiple regression models; relaxing the assumptions of the classical model: multi-collinearity, heteroscedasticity, autocorrelation, model specification. Demand patterns and filtering, horizontal models, trend models, quadratic models, regression, discounting and adaptive smoothing models, trigonometric models, seasonal models, adaptive control models, Box-Jenkins models. *Prerequisite: Senior standing (165 ECTS)*

IE412 Financial Engineering **ECTS 6**

The focus of the course is to introduce students to the main terms in financial engineering such as: Quantitative methods; Time value of money, the Investment setting, Stock market analysis, Financial statement analysis; Basic concepts, Financial ratios and earnings per share, assets, Liabilities; Corporate Finance: corporate investing and financing decisions, Asset valuation; Markets and instruments, Equity investments, Debt investments; Basic concepts, analysis and valuation, Derivative investments, Alternative investments, Portfolio management. *Prerequisite: Senior standing (165 ECTS)*

IE413 Manufacturing Systems **ECTS 6**

The course aim is to provide an introduction to the design and analysis of manufacturing systems and develop students knowledge in three areas: manufacturing processes and computer-integrated manufacturing systems, manufacturing system design and analysis, and modern manufacturing management strategies. The course covers: introduction to materials and engineering drawing, steel making, turning

operations, milling operations, sheet metal operations, casting and heat treatment, plastics, non-conventional manufacturing processes, semiconductor manufacturing and circuit board assembly, evolution of manufacturing systems, inventory model, MRP, JIT and Kanban, flexible manufacturing systems. Assembly line and balancing. Recent Manufacturing strategies. Dynamics of manufacturing systems, performance evaluation of manufacturing systems, problems facing traditional accounting systems, activity-based costing, justification of manufacturing systems. *Prerequisite: Senior standing (165 ECTS)*

IE414 Stochastic Models **ECTS 6**

The focus of the course is on to introduce students with the main terms such as: Markov chains: classification, recurrence, transience, limits theory. Renewal theory, Markov processes, birth-death processes, Applications to queuing, branching, and other models in science, engineering and business, Topics drawn from semi-Markov processes, martingales, Brownian motion. *Prerequisite: Senior standing (165 ECTS)*

IE415 Scheduling and Sequencing **ECTS 6**

This course covers deterministic scheduling and sequencing problems such as single machine scheduling, parallel machine scheduling, flowshop scheduling and jobshop scheduling, sequence scheduling in a stochastic environment, and line balancing. *Prerequisite: Senior standing (165 ECTS)*

IE416 Supply Chain Management **ECTS 6**

Students learn what creates a competitive advantage in SCM. They learn global supply chain management and how to identify facilities, inventory, transportation, information, sourcing, and pricing as the key drivers of supply chain performance. After successful course completion student are expected to evaluate supply chain decisions under uncertain circumstances. *Prerequisite: Senior standing (165 ECTS)*

IE417 Facilities Design and Planning **ECTS 6**

The focus of the course is on to cover the main concepts and techniques for analyzing, designing, and selecting facilities and material handling systems. Students learn design of production, distribution and inventory systems, process design, materials handling, work area design, storage and warehousing, service area planning, machine scheduling, number, size and location of facilities in a system, capacity planning, and design of delivery routes. *Prerequisite: Senior standing (165 ECTS)*

IE418 Queuing Theory **ECTS 6**

The focus of the course is on to cover the main terms in Queuing Theory such as: Markovian queues and Jackson networks, steady-state behavior of general service time queues, priority queues, approximation methods and algorithms for complex queues, simulation, dynamic programming and applications to inventory and queuing. *Prerequisite: Senior standing (165 ECTS)*

IE419 Managerial Economics **ECTS 6**

The focus of the course is on to introduce students to analytical tools and theoretical economic concepts relevant to firm management. Students learn basics about managerial economics theoretical economic concept economic concept relevant to firm management. After successful completion of the course students are expected to be able to apply analytical tools in managerial economics. *Prerequisite: Senior standing (165 ECTS)*

IE420 Technology and R&D Management **ECTS 6**

To combine management skills and leadership theories essential to generating products and excelling in today's global economy. To convey ability how to design jobs, organize hierarchies, resolve conflicts, motivate employees, and create an innovative work environment. Discover how superior management skills can increase funding, generate profit, and improve the effectiveness of technologically based organizations. To outline the challenging issues related to diversity in science and technology organizations and provides insights as to how diversity can be used to enhance creativity. *Prerequisite: Senior standing (165 ECTS)*

IE421 Total Quality Management **ECTS 6**

The focus of the course is on the key concepts, models, and methods that enable managers to effectively manage the development and utilization of technologies. The goal is to develop an awareness of the range, scope, and complexity of the phenomena, issues, and problems related to economics and management of technology and technological innovations. Students learn the complex issues surrounding the managerial tasks with respect to technology. *Prerequisite: Senior standing (165 ECTS)*

IE425 Computer Aided Design and Manufacturing **ECTS 6**

This course aims to provide students with general knowledge of fundamental CAD/CAM concepts. Students learn how to use commercial CAD/CAM software for engineering design; how CAD/CAM can be used in the different stages of design and manufacture of a product. Students also learn how to take an active role in product design and development process as well as prototyping model 3D part and assemblies by using SolidWorks program and analyze the part design using one of the computational methods (e.g. stress analysis). *Prerequisite: Senior standing (165 ECTS)*

IE430 Special Topics in Industrial Engineering **ECTS 6**

This course may cover different topics. For example, stochastic simulation in industrial engineering or operational research which aims at improving student skills in research orientation or robust optimisation, where students work with various applications ranging from supply chains, pricing, risk management, information theory, statistics and engineering design etc. Students learn how apply robust optimisation to uncertain scenarios and outcomes. *Prerequisite: Senior standing (165 ECTS)*

IE440 Current Topics in Industrial Engineering **ECTS 6**

The main objective of this course is to discuss the latest trends and developments in industrial and manufacturing engineering, such as investigating new, intelligent, and agile control architectures and decision making approaches to deal with disturbances and risks. This is an interdisciplinary course which may cover many main topics in industry such as integration of multinational part fabrication into uniform products, embedded and emergent intelligence, control architectures, global supply and distribution chains, data management decision making, autonomy and self-optimization.. Students are expected to gain competences to formulate contemporary engineering problems and communicate them effectively. *Prerequisite: Senior standing (165 ECTS)*

IE450 Seminars in Industrial Engineering **ECTS 6**

This is an interdisciplinary course which may cover many main topics in industry. Students gain specialist knowledge in their field of study as well as basic knowledge in a broader area, with a focus on research

assignments that are suggested by the academic supervisor. This includes developing of the students' skills such as literature search and analysis, mapping techniques, and techniques for collecting, analyzing, and assessing data, but also to acquire linguistic proficiency and comprehension skills as well as the ability to present ideas and arguments effectively through discussions, presentations and writing. *Prerequisite: Senior standing (165 ECTS)*

M

MATH100 Mathematical Skills **ECTS 6**

This is an entry level university course. It aims to prepare students in the fields of economics, management, international business and finance for their calculus course while it provides basic analytical and computational skills for students in social sciences related programs. Students learn basics of numbers and number operators, basic algebra, factor and simplify polynomials and rational expressions, how to solve equations use functions, quadratic functions and parabolas. *No prerequisite*

MATH101 Calculus I **ECTS 6**

This course covers the following topics: Functions of one real variable including polynomial, rational, trigonometric and other functions; Limits and continuity; Derivatives; Rules of derivatives; Derivatives of basic functions; Properties of differentiable functions; Derivatives of higher degrees; Graphing, tangents and normals; Asymptotes, Local and Global extrema; Antiderivatives; Substitution of variables; Antiderivatives of rational functions; Trigonometric functions; Finite sums, algebra rules; The Riemann sums and integral; The Fundamental Theorem of Calculus. *No prerequisite*

MATH102 Calculus II **ECTS 6**

This course attempts to cover the following main areas: Application of Definite Integrals. Transcedental Functions. Techniques of Integration-substitution, trigonometric substitution, partial fractions, integration by parts, Infinite Sequences and Series. Power Series, Taylor and Mc Laurent Series, introduction to multivariable functions, partial derivatives, local extrema of two variable functions, double integrals. *Prerequisite: MATH101*

MATH201 Linear Algebra **ECTS 6**

This is a fundamental course on matrix theory and its applications. It trains students to tackle the linear algebra problems with an emphasis of their respective fields of study. The topics covered in this course include the knowledge of linear systems of equations, the method of Gauss-Jordan elimination, the method of echelon forms, homogeneous systems, elementary row and column operations and determinants, Cramer rule, matrices, elementary matrix operations, inverses equivalent matrices, L-U factorization, vectors in the plane and in the 3D-Space, vector spaces, subspaces, span and linear independence, basis and dimension, homogeneous systems coordinates and isomorphisms, rank of a matrix, inner product spaces, linear transformations and matrices, determinants, eigenvalues and eigenvectors, diagonalization and similar

matrices, diagonalization of symmetric matrices, matrix exponentials, spectral and singular value decompositions, dominant eigenvalue and principal component analysis. Markov chains, age-specific population growth, harvesting of animal populations. *Prerequisite: MATH101*

MATH202 Differential Equations **ECTS 6**

Differential Equations are the language in which scientists and engineers understand practical application of mathematics through their mathematical models. This course covers first-order differential equations and solution methods, modeling with linear equations. second and higher order linear differential equations, undetermined coefficients, variation of parameters, applications of second order equations, series solutions, series solution around an ordinary point, series solution around a regular singular point, Euler equation and Bessel's equation, Laplace transformation, models with second order equations, linear systems, boundary value problems, partial differential equations, separation of variables; heat conduction problem the wave equation; vibration of elastic strings and membranes, Laplace equation: steady state heat conduction further remarks on separation of variables; series of orthogonal functions Bessel and Legendre expansions. *Prerequisite: MATH102*

MATH203 Introduction to Probability and Statistics **ECTS 6**

The aim of the course is to familiarize students with basic probabilistic concepts of random variables and their probability distributions. Students will utilize smart counting techniques to learn how to estimate and constrain probabilities/uncertainties of certain events. We will introduce concepts of sample space, variance and expectation of a single random variable and covariance between two random variables. After introducing probabilistic concepts students will be able to understand basic statistical approach to testing hypothesis using collected data. Students will learn how to use mathematical language and notation to correctly define and answer questions like “Could this result be an artifact of pure chance?” *Prerequisite: MATH101*

MATH204 Discrete Mathematics **ECTS 6**

This course covers the following topics: Basic operations on propositions, and properties of logic operations, valid arguments, basic axioms of sets, subsets, union, intersection, difference of sets, properties, inclusion-exclusion principle, cardinality of sets, relations, functions and types of functions, Peano axioms of natural numbers, weak and strong mathematical induction, well-ordering principle, divisibility and primes, prime factorization, quotient-remainder theorem, techniques of proofs direct, indirect and by contradiction, permutations, combinations and basic counting, binomial theorem, definitions and examples of graphs, connected graphs, trees, comparison of sizes of functions (classes of polynomial, logarithmic etc functions).

MATH205 Numerical Analysis **ECTS 6**

This course attempts to cover the following main areas: Numerical methods for finding zeroes of functions, numerical integration and differentiation, Gauss-Jordan method(s) for solving systems of linear equations, LU and QR factorization, eigenvalues and eigenvectors, non-linear systems of equations, least squares approximation, methods for solving ordinary differential equations. *Prerequisite: MATH101*

MATH207 Vector Calculus **ECTS 6**

This course is a continuation of the topics covered in Calculus I and II. It focuses on functions of 2 and 3 variables, vectors, dot and cross product, projections, partial and directional derivatives, gradients, double and triple integrals, use of polar, cylindrical, spherical coordinates, local and global extrema for two variable functions, Lagrange multipliers, and finally vector fields, line integrals, Green's and Stokes theorems. *Prerequisite: MATH101*

MATH209 Discrete Mathematics II **ECTS 6**

This course is a continuation of Discrete Mathematics I, with some degree of flexibility given to the instructor. Topics in the second course may include predicate logic, recurrence relations, graphs, trees, Eulerian and Hamiltonian circuits, partially ordered sets, matrices, computational complexity, elementary computability, elementary set theory –countable and uncountable sets, cardinality. *Prerequisite: MATH204*

MATH306 Statistical Modeling **ECTS 6**

The aim of this course is to study common statistical techniques. The emphasis will be upon the understanding and use of statistical methodology, and the written communication of the results of data analysis. Students should gain practical experience in elementary data management and analysis techniques. Topics we will cover include tools and methods for describing and summarizing data; inference methods on population means and proportions; prominent sampling distributions and their use in statistical hypothesis testing; calculating confidence intervals of the sample mean; categorical data analysis (Goodness-of-fit tests); single factor analysis (one way ANOVA); simple linear regression and correlation; model validation, residual analysis; multivariate linear regression; multiple testing strategies to curtail family wise type 1 error. *Prerequisite: MATH203*

ME208 Dynamics and Vibrations **ECTS 6**

The course is designed to teach solution techniques for rigid body kinematics. Conservation of momentum and energy are employed to analyze one and two dimensional problems. The use of vectors and free body diagrams for the analysis of dynamic mechanical systems is applied. Topics that are taught in the course are: Kinematics of particle: force and acceleration, work and energy, impulse and momentum; Kinematics of rigid body: force and acceleration, work and energy, impulse and momentum, Vibrations. *Prerequisite: MATH202*

ME210 Strength of Materials **ECTS 6**

Strength of Materials introduces the basics about structural members and their strength, stiffness and stability. Students practices solving practical engineering problems involving stress and strain analysis in elementary structural members, such as bars and beams. After the successful completion of the course they understand issues on strength, stiffness and stability of structures and are able to check safety of existing structures or to design new structural members. *Prerequisite: ENS209*

ME301 Engineering Project I **ECTS 6**

This course covers the tools and – as important – behavioral skills to systematically manage projects for profit and non-profit organizations**.** Students are exposed to the tasks and challenges facing today's projects and in particular, those of the project manager. Students learn how to manage globally distributed teams while adhering to scope, budget, time constraints while balancing project risks and rigorous quality

demands. Students are expected to acquire and fine-tune the skills and techniques for the 4 phases in the life cycle of a typical project: initiating, planning, executing and closing; gain an understanding of essential principles associated with effective project management and how to apply these principles in the day-to-day business environment; familiarize themselves with commonly available computer software tools and apply methods for solving common difficulties associated with project management. *Prerequisite: Junior Standing (108 ECTS)*

ME302 Engineering Project II **ECTS 6**

Continuation and completion of projects begun in ME301. *Prerequisite: Junior Standing (108 ECTS)*

ME304 Fluid Mechanics **ECTS 6**

The course aims to give students fundamental knowledge in fluid mechanics, to teach them basic problem solving skills in hydrostatics and fluid dynamics, and make them aware of role of fluid mechanics in various engineering applications and design. Throughout the course students define the physical properties of a fluid and explain the consequence of such properties on fluid flow, apply integral relations for a control volume to compute various fluid mechanics problems, apply the conservation principles of mass, linear momentum, and energy to fluid flow systems, compute various problems of fluid flow in ducts, compute the lift, drag, and moments acting on simple aerodynamic profiles and shapes in inviscid, steady fluid flows and apply CFD software to compute fluid dynamics problem with moderate level of complexity. *Prerequisite MATH202*

ME306 Heat and Mass Transfer **ECTS 6**

The course aims to introduce basic concepts and principles of heat transfer encountered in mechanical engineering practice. It covers analytical, empirical and numerical techniques for the solution of heat transfer problems. At the end of course diffusion mass transfer will be introduced. Throughout the course students Identify the mechanisms of heat transfer that occur simultaneously in practice, solve one-dimensional heat conduction problems and obtain the temperature distributions within a medium, solve steady conduction problems that involve multilayer rectangular, cylindrical, or spherical geometries, analyze transient heat transfer problems and solve it when lumped system approach is applicable, calculate various characteristics of internal and external convection heat transfer problems and calculate basic problems of mass transfer. *Prerequisite MATH202*

ME312 Machine Elements **ECTS 6**

Machine Elements introduces classification of a variety of machine elements, their aim and proper use. It teaches students fundamental principles of design of engineering systems and their mechanical parts and how to apply methods of statics, strength of materials and kinematics in analysis of practical engineering problems. Students also learn how to assess behavior and the effects of shape, dimensions and material of an element, or type and level of load. *Prerequisite ME210*

ME313 Mechanical Vibrations **ECTS 6**

This course covers topics such as: one- and multi-degree-of-freedom systems; natural frequencies and modes of vibrations, resonance, beat phenomenon, effect of damping, applications to practical problems, and methods to avoid excessive vibrations. The main course objective is to equip students with fundamental

knowledge on the modeling and analysis of one-dof-systems - free vibrations, transient and steady-state forced vibrations, viscous and hysteric damping. *Prerequisite: Junior Standing (108 ECTS)*

ME370 Work Placement/Internship **ECTS 6**

An internship experience provides the student with an opportunity to explore career interests while applying knowledge, skills and competences gained in the classroom in a work setting. The experience also helps students gain a clearer sense of what they still need to learn and provides an opportunity to build professional networks. *Prerequisite: Junior Standing (108 ECTS)*

ME401 Engineering Design I **ECTS 6**

Engineering Design course gives students the opportunity to develop skills and understanding of course concepts through activities, projects, and problem-based (APPB) learning. The major focus of the IED course is to expose students to design process, research and analysis, teamwork, communication methods, global and human impacts, engineering standards, and technical documentation. *Prerequisite: Junior Standing (108 ECTS)*

ME402 Engineering Design II

This course focuses on manufacturing processes. Students are expected to demonstrate thorough understanding of manufacturing processes. As future engineers, the students should be able to consider these processes so they can make the manufacturing of a product more efficient and cost effective.
Prerequisite: Junior Standing (108 ECTS)

ME410 Unmanned Aerial Vehicles **ECTS 6**

The main objective of the course is to introduce students to principles of operation of unmanned aerial vehicles. The course will enable students to understand physics of unmanned aerial vehicles and auxiliary subsystems. Safety, ethical and environmental issues are analyzed as well.
Prerequisite: Junior Standing (108 ECTS)

ME411 Renewable Energy Technology **ECTS 6**

This course aims to provide an introduction to power systems, its basic components and their functioning, focusing on renewable energy resources, their technologies and applications. The course will help students recognize society's present needs and future energy demands and identify imposed challenges due to conventional ways of electric and thermal energy generation. Accordingly, it aims to motivate students to explore, analyze and utilize various renewable energy sources´ potential, due to applicability for given sites (using professional software tools). The course, within its scope, will also focus on helping solve environmental and economic problems in the society, directing it towards sustainable development. *Prerequisite: Junior Standing (108 ECTS)*

ME412 Introduction to Computational Fluid Dynamics **ECTS 6**

The purpose of this course is to enable students to use CFD codes for engineering analysis and design tasks. Students gain working knowledge of computational fluid dynamics through introducing the (mathematical) background and theory to computational Fluid Dynamics (CFD) based on finite volume method. Students learn the limitations of CFD codes and their application to fluid flow problems. Practical sessions of running a proprietary CFD package are part of the course. *Prerequisite: Senior Standing (168 ECTS)*

ME414 Energy Conversion Technology **ECTS 6**

The course covers topics related to modern energy conversion systems (power generation systems), fundamentals and principles of thermodynamics energy transfer in a variety of engineering systems. Students learn application of the laws of thermo-fluid mechanics to energy conversion systems and obtain an insight into up-to-date technical systems for energy conversion, their components and processes, as well as economic and environmental importance of energy conversion. *Prerequisite: Senior Standing (168 ECTS)*

ME415 Computational Methods **ECTS 6**

The course focus is on program design, algorithm development and verification, and comparative advantages and disadvantages of different computer languages. Students learn how to use computer languages to analyse contemporary scientific problems. The course covers both conceptual areas of converting a problem to be solved into a computer-based solution, and specific aspects of individual languages and the types of problems they are best suited to solve. *Prerequisite: Senior Standing (168 ECTS)*

ME416 Turbo-machinery **ECTS 6**

This course covers provides general information on types of turbo-machines by combining theory and applications. Students learn how gas turbines, pumps and compressor function. The course relates turbo-machines to areas such as wind power and three-dimensional effects in axial turbo-machines. Students are expected to gain knowledge on smooth transition from the study of thermodynamics, fluid dynamics, and heat transfer to the subject of turbo-machinery. *Prerequisite: Senior Standing (168 ECTS)*

ME430 Hydraulics and Pneumatics **ECTS 6**

This course is a study of fluid power technology using fluids or compressed air as the transfer media. Complete hydraulic and pneumatic systems are studied including power sources, reservoirs, pumps, compressors, lines, valves and actuators. Students will learn troubleshooting strategies to identify, localize and correct malfunctions. Preventative maintenance and safety issues will also be discussed. *Prerequisite: Senior Standing (168 ECTS)*

ME432 HVAC **ECTS 6**

This course presents a working foundation of refrigeration, air conditioning and heat pump theory and application and equips students with essential knowledge of electrical troubleshooting and understanding of schematic wiring diagrams. Students learn the most important concepts on heating and cooling of buildings and energy transfer. After successful completion of the course, students will be able to apply the above concepts to the design of HVAC systems and evaluate heating and cooling load of a building. Prerequisite: Senior Standing (168 ECTS)

ME436 Plumbing System and Design **ECTS 6**

The course covers the fundamentals of pressurized water distribution and sanitary systems for commercial and residential buildings. Topics include general overview of fluids, construction design, plumbing code, pressure flow equations, friction, mechanical pumping, cold and hot water distribution, water heater selection, backflow prevention and application. After successful completion of the course students will be able to analyse plumbing system and design. *Prerequisite: Senior Standing (168 ECTS)*

N

NS102 Physics **ECTS 6**

The course covers a calculus-based study of the basic concepts of physics. Topics include vector algebra, kinematics, dynamics of single particle system, energy, momentum, conservation laws, circular and rigid body motion, fluid mechanics, thermal equilibrium, temperature, and the laws of thermodynamics with applications to ideal gases and thermodynamic processes. *No prerequisite.*

NS103 Biology **ECTS 6**

The course covers the introductory level methodology, principles, and mechanisms of biological sciences with special emphasis on molecular and cellular aspects of living systems as well as biological chemistry, cell structure and function, cellular metabolism, genetics, and other related topics. *No prerequisite.*

NS104 General Chemistry **ECTS 6**

A fundamental chemistry course emphasizing the metric system, introduction to atomic theory, stoichiometry, the structural and physical properties of matter, the electronic structure of atoms chemical binding, molecular geometry, hybridization and molecular orbital and the states of matter, i.e., gases, liquids and solids. It also discusses physical properties of solutions in aqueous solution, chemical kinetics, and chemical equilibrium. *No prerequisite.*

NS111 Understanding Nature and Knowledge **ECTS 3**

The course covers topics such as history and philosophy of science, perception of the world and interaction with science, impact of recent scientific breakthrough on modern life. *No prerequisite.*

NS112 Understanding Science and Technology **ECTS 3**

The aim of the course is to expose students to various issues and opinions on the development, the current state and the role of the science and technology in the development of human societies. The goal is not to give definitive answers but rather to provoke discussion and initiate further learning. *No prerequisite.*

NS202 Biochemistry I **ECTS 6**

The course provides introduction to the foundations of chemistry in living organisms. A special emphasis is given into the properties of biological macromolecules such as DNA, RNA and proteins, including enzyme kinetics and purification methodologies. *Prerequisite: NS207*.

NS203 Physical Chemistry **ECTS 6**

Physical Chemistry uses theoretical structures and tools of physics to study and predict the physical, thermal, electrical, and chemical properties of all living matter. This course covers the thermodynamics and chemical kinetics; properties of gases; physical and chemical transformations of matter; kinetic theory of gases and electrochemistry. Further it focuses on Quantum theory; atomic structure and spectra; molecular structure and statistical thermodynamics, Ions transport and diffusion, rates of reactions, molecular dynamics and catalysis. *Prerequisites: NS102 and NS104.*

NS205 Cell Biology **ECTS 6**

This course introduces the basics of cell biology which enables students demonstrate preparedness for higher-level biology courses with special emphasis is on cell structure and function, cell division, and other related topics. Laboratory exercises focus on microscope techniques. *No prerequisite.*

NS207 Organic Chemistry **ECTS 6**

This course covers common organic chemistry knowledge, including general structures of biological molecules, their major classifications and functional groups. Additionally, it covers reactivity between them, such as acid-base reactions and nucleophilic substitutions. Moreover, techniques used for determination of the structure of organic compounds are also covered, including mass spectrometry, IR and UV spectrophotometry and nuclear magnetic resonance. *No prerequisite.*

NS209 Genetics I **ECTS 6**

This course aims to introduce the basic concepts in genetics, and explains the principles and mechanisms of heredity. It also provides information about genetic mapping, chromosomal changes, population genetics and quantitative genetics. *No prerequisite.*

NS211 Analytical Chemistry **ECTS 6**

This course covers basic analytical processes and measurement techniques within chemistry. More specifically, it focuses on equilibrium states within the solutions (such as acid and bases), structure and function of compounds, their chemical reactions and techniques used to measure them. Additionally, it covers experimental error and statistics, relationship between acids and bases, redox and precipitation titrations, electroanalytical techniques, and advanced applications in analytical chemistry. *Prerequisite: NS104.*

NS307 Introduction to Research Methods **ECTS 6**

This course provides an opportunity for students to establish or advance their understanding of research through critical exploration of research language, ethics, and approaches. The course introduces the language of research, ethical principles and challenges, and the elements of the research process within quantitative, qualitative, and mixed methods approaches. Participants will use these theoretical underpinnings to begin to critically review literature relevant to their field or interests. *No prerequisite.*

S

SE211 Software Construction **ECTS 6**

Software Construction presents the basic principles and techniques of software development. Special attention is paid how to write the software code that is bug-free, easy to maintain, understandable, extensible and reusable. During the course students will tackle the set of problems and a final project. The particular attention is paid to the topics such as specifications and invariants; testing; abstract data types, simple and complex; design patterns for object-oriented programming; notions of concurrent programming and concurrency. *Prerequisite: CS103*

SE302 Software Testing and Maintenance **ECTS 6**

This course is a study of software testing and maintenance methodologies for to develop object-oriented, component-based software using the Test Driven Development approach. The main theoretical and practical topics are different types of coverage analysis, automatic test case generation, and regression testing and impact analysis. A primary focus will be program-based software testing and maintenance approaches and related software development techniques. Students will work on several problems using Unit Tests for object oriented programming environment. *Prerequisite: CS105 or SE211*

SE304 Tools and Methods of CASE Technologies **ECTS 6**

CASE stands for Computer Aided Software Engineering. The course covers CASE tools i.e. a set of software application programs, which are used by software project managers, analysts and engineers to develop software system. Students learn CASE tools and methods to simplify various stages of software development process, such as analysis tools, design tools, project management tools, database management tools, etc. *Prerequisite CS105 or CS204*

SE308 Communication Systems and Networks **ECTS 6**

This course provides knowledge and identifies principles behind advanced high-speed computer networks and Internet; to enable to understand issues and implementation considerations relevant to providing services in advanced communication networks and Internet. Students will learn how to describe the layered organization and structuring of computer networks, identify and analyze the key design parameters and their effect to provide consistent services in computer networks, analyze the key problems involved at the layers of the TCP/IP protocol stack and apply the techniques and algorithms that have been devised to address these problems, maintain small network, to design small and medium network and to be a part of team to maintain a large network. *Prerequisite: CS105.*

SE322 Software Requirements Analysis **ECTS 6**

Students will learn and train how to use requirements engineering techniques to capture software requirements for all types of real world problems. Particular attention will be paid on how to work with clients and non-specialists in Computer Science, how to negotiate and work with final users of the system. The course covers elicitation, specification, and management of software system requirements. The course will present the iterative techniques to develop full requirement analysis. The course assumes students have the basic familiarity with the subject of gathering requirements and basics of software development or other engineering projects. *Prerequisite: CS105 or SE211.*

SE370 Work Placement/Internship **ECTS 6**

An internship experience provides the student with an opportunity to explore career interests while applying knowledge, skills and competences gained in the classroom in a work setting. The experience also helps students gain a clearer sense of what they still need to learn and provides an opportunity to build professional networks.[6]

SE401 SCADA Systems **ECTS 6**

Design to teach students the theoretical and practical foundations of software design for Supervisory Control and Data Acquisition (SCADA) systems. Topics include: the SCADA scan cycle, fundamentals of SCADA communication, sensors, actuators and rewiring, operator interface and the HMI, SCADA integration. *Prerequisite: MATH101, CS105 or SE211*

SE402 Programming of CNC Machines **ECTS 6**

During the course the students learn the basics of CNC machines as well as the fundamentals of CNC programming. Topics include: CNC production, coordinate systems, cutting speeds for milling and drilling, drawing basic shapes using geometric methods, write simple programs to operate computer-numerically controlled milling machines, CAD-CAM software tools etc. *Prerequisite: CS105 or CS204.*

SE403 Development of Science and Technology **ECTS 6**

This course introduces the field known as Development of Science and Technology and in particular with the respect to the digital world. STS is an interdisciplinary field that examines how science and technology shape societies, cultures, and the environment and how social, cultural, and environmental factors shape the development of science and technology. Students will study the latest development in the digital technologies and the societal aspects of it but also biological science (including biotechnology, genetics, and genomics); medical sciences and technologies; energy sciences and technologies; and ecological and environmental sciences. Key terms necessary to understand and discuss those perspectives are also presented. Upon the completion of the course the students will be able to explain developments in science

[6] IMPORTANT NOTE ON WORK PLACEMENT/INTERNSHIP: The students are expected to: 1. Familiarise himself/herself with the IUS Procedures and Rules for Work Placement/Internship 2. Arrive at work as scheduled, ready to work, and stay for the agreed upon time 3. Present him/herself in a professional manner at all times, including being appropriately dressed for your workplace. 4. Communicate any concerns with their supervisor and the internship coordinator in a timely manner and respectfully. 5. Demonstrate enthusiasm and interest in what you are doing; ask questions and take initiative as appropriate. 6. Complete and submit your internship file by designated deadlines. 7. Keep track of and accurately report internship hours worked. (Completion of the work assigned by the employee. Report of the performed work is also checked by the Program Coordinator at the end of the semester. The internship could be evaluated as ACCEPTED, REJECTED or INCOMPLETE. In order for students to receive 6 ECTS, the internship report needs to be ACCEPTED.)

and technology in terms of their interactions with social, cultural, environmental, and other issues. *Prerequisite: CS105 or CS204*

SE404 Psycho Cybernetics **ECTS 6**

The course is designed to help students lead more successful and fulfilling lives by learning and applying the foundations of psycho-cybernetics. The course revolves around introducing the idea of self-image in psychology and the idea of personal creativity as desirable tools for a successful software engineer. By the end of this course, the students should have increased their self-awareness, and by understanding their unconscious blueprint of themselves, they improve their chances for self-growth, self-improvement and become more ready to recognize and embrace new opportunities for creativity and innovation. *Prerequisite: CS105 or CS204*

SE406 Software Engineering Management **ECTS 6**

Software engineering management is introduced to the students as the application of management activities—planning, coordinating, measuring, monitoring, controlling, and reporting1—and all this to ensure that software products and software engineering services are delivered efficiently, effectively, and to the benefit of stakeholders. While it would be possible to manage a software engineering project in the same way as other complex projects there is many aspects very particular to software projects and software life cycle processes. Students will study how to work with clients and developers at the same time and continuously, particularly regarding the impact of changing requirements. The impact, and how to deal, of the high degree of novelty and complexity in the requirements and underlying technology is studied extensively. *Prerequisite: CS105 or SE211*

SE407 Software Quality Management **ECTS 6**

The course will develop the advanced set of skills to ensure the required level of quality in a industrial software product. Beside the software engineering techniques, the course present and define the quality standards and procedures that follow. The term of „quality culture“ is discussed throughout the course. Particular attention is paid to quality assurance, quality planning and quality control and what are the keys for effective quality management. The place of Software Quality Management and process is studied and defined in the typical software engineering project. Students will work on several real world case studies and will have to submit the final project. *Prerequisite: CS105 or SE211*

SE421 CAD Systems **ECTS 6**

Introduces students to computer-aided drafting and design. It teaches the foundations of computer graphics and design, using graphical software and hardware. Upon completion of this course, the student should have the ability to make 2D CAD drawings, sketches, analyses, models, and evaluate models in CAD software. The students will have the ability to manipulate the coordinate systems, perspectives and transformations; they will be able to construct sketches and set geometric and topological boundaries on them. *Prerequisite: CS105 or CS204*

SE423 Automatics and Robotics **ECTS 6**

This course introduces the basic principles of automated systems and describes the tasks that technicians perform on the job. The main topics include the history, development, and current applications of robots

and automated systems including their development, configuration, operation, components, and controls. Upon completion, students should be able to understand the basic concepts of automation and robotic systems. *Prerequisite: CS105 or CS204*