A'Sharqiyah University

College of Engineering

Department of Energy and Sustainable Engineering

Bachelor of Science in Energy Engineering Program

Course Descriptions

University Requirements (12 CH)

ARAB101 Arabic (3 CH)

يعنى هذا المقرر بتنمية مهارات اللغة العربية: الاستماع، والتحدث، والقراءة، والكتابة؛ وذلك من خلال دراسته لجملة من النصوص المنتقاة التي نركز فيها على طرح أسئلة تتعلق بكل مهارة، ويعنى هذا المقرر في مهارة الكتابة بدراسة التحرير الوظيفي، مثل: كتابة الرسالة الرسمية، وطريقة كتابة التقارير، ومعرفة الأساسيات في كتابة محضر الاجتماعات، وكتابة المقال. كما يدرس الطالب كذلك بعض القواعد المساعدة في إجادة اللغة العربية، كالقواعد النحوية والإملائية.

ENGL101 English Communication Skills I (3 CH)

This course develops students' proficiency through grammar instruction and fluency exercises. While the emphasis of the class is on speaking and listening, there are also reading and writing exercises which reinforce the grammar and vocabulary students learn. Finally, students are required to participate in discussions regularly basis and give several presentations.

OMNS101 Omani Society (3 CH)

يهدف المقرر إلى تعزيز وعي الطلبة بهوية المجتمع العماني وقيمه ومؤسساته، وفهم دور المتغيرات التاريخية والديمغرافية والثقافية في تشكيل الهوية العمانية وتحديد سماتها، والتعريف بالهيكل الإداري للدولة، ومنطلقات النهضة العمانية المعاصرة ومبادئها، كما يهدف المقرر أيضا إلى تعزيز قيم المواطنة المتمثلة في الانتماء والولاء والمشاركة المجتمعية والقيم العامة والحقوق وحقوق المواطن وواجباته، وأيضا التعريف بعلاقات السلطنة ودورها على المستوى الخليجي والعربي والدولي بما في ذلك المعاهدات والمواثيق الدولية، كما يهدف المقرر إلى تسليط الضوء على قضايا الأمن الفكري، والمواطنة الرقمية والمشكلات الاجتماعية المعاصرة في المجتمع العماني.

MNGT313 Entrepreneurship (3 CH) (Pre-R: 60 CH)

This course is an introductory course in Entrepreneurship and Innovation. The course aims to expose students to business venturing and entrepreneurial activity. The students would apply knowledge and skills acquired during the course by developing and evaluating their business ideas. This course is an introductory entrepreneurship course that focuses on the vital role played by entrepreneurs and entrepreneurship in the 21st-century global economy. The process of successfully launching and growing an entrepreneurial venture by applying the entrepreneurial process is examined. The course integrates several different disciplines, ranging from sociology and psychology to economics, finance, marketing, and human resource management. It is a course that mixes theory with practice by applying principles, concepts, and frameworks to real-world situations.

College Requirements (32 CH)

ENGR111 Computer Applications (3 CH)

The course teaches students how to use MATLAB and visual basic programming languages in a numerical computing and integrated development environment. The topics covered in the course include using variables, solving problems, data analysis functions, manipulating matrices, plotting, data presentation, logical operators, flowcharts, pseudocode, selection structures, and an introduction to Visual Basic programming language with its applications.

PHYS111 Applied Physics (3 CH)

This course is a design course to increase understanding of the basic concepts of physics is fundamental for developing students' understanding of the more applied scientific disciplines such as Chemistry, Biology and other Applied Sciences.

MATH101 Calculus I (3 CH)

The aim of this course is to lay a firm foundation for students in calculus. The course will introduce students to the concepts of limits, continuity, derivatives, hyperbolic functions and integrals. It will develop mathematic critical thinking and problem-solving skills.

PHYS181 Physics Lab (1 CH) (Co-R: PHYS111)

Physics is an experimental science. The theory that is presented in lectures has its origins and is validated by experimental measurement. PHYS181 explores the practical aspect of physics and the basic principles and concepts in physics as taught in theory are applied in the laboratory. It is designed for students who will take their undergraduate degree programs in engineering and applied sciences.

MATH102 Calculus 2 (3 CH) (Pre-R: MATH101)

The aim of this course is to lay a firm foundation for students in calculus. The course will introduce students to the concept's definite integrals, integration by substitution, integration by parts, sequences and series. This course also introduces students to the concepts of vector and scalar product, partial derivatives, solution of first-order ODE's and PDE's.

CHEM101 Chemistry (3 CH)

This course presents the basic concepts and methodologies for understanding chemical phenomena. Stoichiometry of chemical reactions, quantum mechanical description of atoms, the elements and periodic table, chemical bonding, real and ideal gases, thermochemistry, introduction to thermodynamics and equilibrium, introduction to chemical kinetics, acid-base and solubility equilibria, introduction to oxidation-reduction reactions.

ENGL102 English Communication Skills II (3 CH) (Pre-R: ENGL101)

This course further develops reading sub-skills, comprehension, and vocabulary. The texts are more demanding lexically and structurally than ENGL101 and are mainly literary. Written and oral activities require students to respond to these texts critically.

CHEM181 Chemistry I Lab (1 CH) (Co-R: CHEM101)

This is a one-semester laboratory course intended as the companion course for CHEM101 theory and is an introductory lab course focusing on basic principles and concepts in chemistry. It provides the basis for further studies in physical and biological sciences, environmental sciences, various

engineering disciplines, applied sciences such as food sciences and nutrition, geology and metallurgy, pharmaceuticals, interdisciplinary areas like nano science and technology etc. Topics include laboratory safety, chemical measurements, significant figures, laboratory techniques, naming and chemical formulae of compounds, chemical reactions - acid –base titrations and cation & anion analysis, stoichiometry problems, calorimetric experiments for heat of reactions etc.

ENGR201 Engineering Drawing (3 CH)

This course provides basic knowledge and skills of engineering drawing so that students can efficiently develop engineering plans and details. Main topics include freehand sketching, principles of orthographic projection, dimensioning, section, isometric and working drawings, 2D and 3D drawings using AutoCAD.

MATH204 Probability and Statistics (3 CH) (Pre-R: MATH102)

Basic concepts of descriptive statistics, statistical inference, regression, correlation analysis, hypotheses test, and confidence intervals, elements of set theory, sample space and events, probability, conditional probability and independence, examples of discrete and continuous probability distributions, multivariate probability distributions, functions of random variables, and central limit theorem.

MATH305 Numerical Methods (3 CH) (Pre-R: MATH102, ENGR111)

This course will emphasize the development of numerical algorithms to provide solutions to common problems formulated in science and engineering. The primary objective of the course is to develop the basic understanding of the construction of numerical algorithms, and perhaps more importantly, the applicability and limits of their appropriate use. The emphasis of the course will be the thorough study of numerical algorithms to understand the guaranteed accuracy that various methods provide, the efficiency and scalability for large scale systems, and issues of stability. Topics include the standard algorithms for numerical computation: root finding for nonlinear equations, interpolation and approximation of functions by simpler computational building blocks (for example - polynomials and splines), numerical differentiation and divided differences, numerical quadrature and integration, numerical solutions of ordinary differential equations and boundary value problems, numerical optimization and regularization algorithms.

MATH203 Differential Equations (3 CH) (Pre-R: MATH102)

Solution of first-order ODE by analytical, graphical, and numerical methods. Linear ODE's with emphasis on the second order with constant coefficients. Sinusoidal and exponential signals. Fourier series and periodic solutions. Delta functions, convolution, and Laplace Transform methods. Matrix and first-order linear systems. Classical partial differential equations of applied mathematics are covered: diffusion, Laplace/Poisson, and wave equations. Methods and tools for solving PDEs: separation of variables, Fourier series, and transforms.

ENGR322 Summer Internship (0 CH)

This course is basically focused on practical and project based-training, research and development, communication and development skills, costing and safety awareness, exposure to data collection, troubleshooting, improvement, design and development of systems, and understanding on system operation as whole.

Program Requirements (78 CH)

EGEN201 Energy and Sustainable Development (3 CH)
This is an introductory course to energy engineering. The course focuses on providing an outline to energy and its sources, generation, affordability, sustainable development, and modern energy. Course contents include electrical power generation, renewable and non-renewable energy. Economic, community, and environmental aspects of sustainable energy development are elaborately discussed.

EGEN221 Circuit Theory (3 CH) (Pre-R: MATH102)
This course covers a wide range of topics starting from basic electrical circuit's concepts, basics laws such as ohm's law, KVL and KCL, circuit solving techniques (Nodal and Mesh analysis), circuit theorems, energy storage elements (capacitors and inductors), AC circuits analysis, power in AC circuits, and three-phase circuits.

ENGR202 Technical Writing and Presentation (3 CH) (Pre-R: ENGL102)
The objectives of this course are to develop engineering students' abilities to improve the communication skills and specialist language knowledge of engineers; to listen to and speak about engineering-related situations; to ask and answer important engineering-related questions; and to present engineering projects in an engaging and convincing format.

CVEN361 Environmental Engineering (3 CH) (Pre-R: CHEM101)
This course teaches environmental science from engineering approach. It covers an introduction to environmental engineering, water pollution, air pollution, soil contamination, hazardous and solid waste.

EGEN222 Circuit Theory Lab (1 CH) (Pre-R: MATH102, Co-R: EGEN221)
Laboratory experiments covering basic DC and AC electric circuits. Measurement equipment and instrumentation are introduced along with experiments demonstrating circuit analysis techniques, and AC steady state circuits. An emphasis will be given on data interpretation and report writing skills.

EGEN251 Fluids Mechanics (3 CH) (Pre-R: MATH102)
This course introduces the engineering students to the principles of fluid mechanics and the application of theories to typical engineering problems such as: flow in pipes, fluid measurement, and calculation of fluid forces. Students completing this course should have the tools necessary for the analysis of field problems in fluid mechanics.

EGEN261 Engineering Mechanics (3 CH) (Pre-R: MATH102)
This course prepares students with all relevant physical properties and fundamental laws governing the behavior of materials and structures. Topics include equivalent systems of forces, resultants and distributed forces, rigid body equilibrium, centroids, center of gravity, moments of inertia, work, energy, and power. Additionally, frames and machines will be analyzed, and the forces in beams, internal stresses, and stability are examined.

EGEN262 Thermodynamics and Heat Transfer (3 CH) (Pre-R: PHYS111)
This course introduces students to heat transfer and thermodynamics. The heat transfer part of the course covers the mechanisms and basic calculations of three heat transfer modes: conduction,

convection and radiation, and Heat exchanger design and performance estimation calculations. The Thermodynamics part of the course mainly discusses the fundamental laws and principles of thermodynamics.

EGEN263 Thermo-Fluid Lab (1 CH) (Pre-R: PHYS111, Co-R: EGEN251, EGEN262)
In this course experiments are conducted covering properties of fluid, flow visualization, difference between laminar and turbulent flow, fluid measurement devices, energy losses in pipelines, mechanism of heat transfer (conduction, convection and radiation), thermodynamics power, refrigeration cycles, and. An emphasis will be given on data interpretation and report writing skills.

EGEN333 Electronics (3 CH) (Pre-R: EGEN221)
Introduction to electronic devices including diodes, field effect transistors, and bipolar junction transistors. Design and analysis of single-stage amplifiers using FETs and BJTs. Op Amp and its applications. The course includes hands-on hardware and software (PSpice or NI Multisim) laboratory sessions.

EGEN320 Combustion and Heat Generation (3 CH) (Pre-R: EGEN201)
This course introduces the students to combustion reactions and engines, engine design and emission control technologies, properties of gaseous, liquid and solid fuels, combustion reaction basics, heat, and efficiency and combustion reaction and generated heat applications.

EGEN344 Power Systems (3 CH) (Pre-R: EGEN221)
The course discusses the fundamentals of AC power systems such as generation, transmission, and distribution of electric power. The parameters of overhead transmission lines and underground cables will be analyzed and their performance will be evaluated. Per unit analysis, symmetrical faults and load flow study will be covered as well. Software such as MATLAB will be utilized in analyzing some of the course topics.

EGEN334 Electronics Lab (1 CH) (Pre-R: EGEN221, Co-R: EGEN333)
Laboratory experiments covering basic electronic devices including diodes, field effect transistors, and bipolar junction transistors. Design and analysis of single-stage amplifiers using FETs and BJTs. The course includes hands-on hardware and software (PSpice or NI Multisim) laboratory sessions.

EGEN385 Electrical Machines (3 CH) (Pre-R: EGEN221)
Basic concepts of electrical machines, transformers, AC machines including synchronous generators, synchronous motors and induction motors. The course includes hands-on hardware and software (MATLAB) laboratory sessions.

ENGR404 Engineering Economics (3 CH) (Pre-R: MATH204)
Basics of cost analysis and accounting. Application of engineering economics to decision making. Ethical impacts associated with these decisions. Analysis of engineering alternatives based on use of interest computations, valuations, depreciation, and cost estimates.

EGEN381 Fossil Fuel Power Plants (3 CH) (Pre-R: EGEN320)
This course introduces the basic principles of conventional energy conversion processes for power generation. Characterization of electrical energy produced from fossil power plant. The heat

technologies of production electrical energy. The fossil and fissile fuels used as hot source of thermodynamic cycles: Gas turbines, steam turbine power stations, combined cycles, nuclear power plants, etc. Study the operating principles of fossil power plants. Internal combustion diesel engines and discussion of environmental issues associated with fossil fuel use.

EGEN482 Instrumentation and Control Systems (3 CH) (Pre-R: EGEN344)
Fundamentals of instrumentation and measurement techniques with their applications. The course covers the measurements of physical quantities with applications of sensors and actuators on control systems. The course also develops the practical skills of the students by providing mini projects in instrumentation and industrial control systems.

EGEN421 Wind Energy (3 CH) (Pre-R: EGEN385)
This course introduces the fundamental disciplines of wind energy such as wind measurements and resource assessment, aerodynamics, wind turbine technology, structural mechanics, materials, financial and electrical systems.

CVEN471 Engineering Project Management (3 CH) (Pre-R: MNGT313)
This course will prepare students to build their skills in areas of project management. The course will also include training on MS Project 2013/Primavera P6.

EGEN443 Power Electronics and Drives (3 CH) (Pre-R: EGEN333, EGEN385)
Fundamentals of power electronics and applications. Power semiconductor devices, switch-mode power conversion, power supplies, inverters, and introduction to DC and induction motors derives.

EGEN471 Modelling and Simulation of Energy Systems (3 CH) (Pre-R: MATH305, MATH203)
This course provides foundations of modelling and simulation and how it is used in the process of energy systems. The course focuses on important mathematical and algorithmic techniques and their applications to energy systems. The course introduces modelling techniques and algorithms include dynamic modelling, optimization, and control of selected energy systems, such as solar, wind and geothermal systems as well as building energy systems. The course gives an emphasis on the ethical issues that should be considered while modelling and designing energy systems.

EGEN461 Energy Storage Technology (2 CH) (Pre-R: EGEN443)
This course introduces students to energy storage systems and provides a broad understanding of the scientific principles that underpin the operation of such systems. The emphasis is on utility-scale energy storage as a means of addressing the intermittency of renewable energy components (e.g. solar or wind power systems) of modern electricity networks. Smaller energy storage systems are also discussed for benchmarking and comparisons.

EGEN491 Capstone Design Project I (3 CH) (Pre-R: ENGR404)
This course deals with a design project of an energy engineering system that involves more than one energy specialization. Students work in groups under close supervision of faculty members. The course involves planning, designing, and selecting production technologies of energy and their implication. The course develops students' capabilities in decision-making strategies of planning and managing resources while considering their ethical issues.

EGEN422 Solar Energy (3 CH) (Pre-R: EGEN443)
This course introduces the technologies that convert solar energy into electricity, heat and solar fuels with a focus on electricity generation. Photovoltaic (PV) devices are presented as advanced semiconductor devices that deliver electricity directly from sunlight. The emphasis is on understanding the working principle of a solar cell, fabrication of solar cells, PV module construction and the design of a PV system. The course also includes hands-on laboratory sessions in solar energy and solar cells.

EGEN481 Energy Lab I (1 CH) (Pre-R: EGEN421, Co-R: EGEN422)
This course introduces laboratory experiments covering renewable energy sources and. The course covers experiments on PV modules and wind energy systems.

EGEN561 Hydrogen and Fuel Cell Fundamentals (3 CH) (Pre-R: CVEN361)
This course covers the fundamentals of fuel cells such the fuel cell thermodynamics, reaction kinetics, charge transport, and mass transport. Hydrogen as fuel and its electrochemical properties. In addition, the course discusses the fuel cell modeling and characterization. The course studies different types of fuel cell and fuel cell system as well.

EGEN523 Distributed Generation (3 CH) (Pre-R: EGEN344)
This course equips the students with the basics of distribution network modelling, the different types of distributed energy sources utilized (Co-generation/CHP, wind, hydro, photovoltaics) and their integration into electric grid, and their impact on the fundamental operation of the distribution and transmission networks, and operation of market frameworks.

EGEN592 Capstone Design Project II (3 CH) (Pre-R: EGEN491)
This course is a continuation of the course EGEN491.The aim of this course is to prepare the student for professional energy engineering work.

EGEN513 Energy Safety and Risk Assessment (2 CH) (Pre-R: EGEN201)
This course introduces students to the fundamental elements of an effective health and safety management system. It includes topics concerning hazard identification and risk assessments, hazard control and the hierarchy of controls, formal and site-specific hazard assessments, workplace inspections and hazard reporting, programs for preventative maintenance and hazardous products.

EGEN513 Energy Lab II (1 CH) (Pre-R: EGEN461, Co-R: EGEN561)
This course introduces laboratory experiments covering battery energy storage systems and hydrogen fuel cells. This course prepares students with experimental skills involving practical testing of energy storage devices and fuel cells. This course requires the use of mathematics, engineering topics and design.

Program Electives (Choose three courses of 9 CH)

ENEN581 Climate Change (3 CH) (Pre-R: CVEN361)
This course introduces the science of climate change, what factors cause climate to change across different time scales and how those factors interact; how climate has changed in the past; and the possible consequences of climate change for our planet. The course explores evidence for changes in ocean temperature, sea level and acidity due to global warming. Finally, the course looks at the

connection between human activity and the current warming trend and considers some of the potential social, economic and environmental consequences of climate change.

EGEN203 Engineering Materials (3 CH) (Pre-R: MATH102)
This course focuses on providing an outline to atomic bonding, crystal structure and defect structure, and their relationship with material properties. It also includes phase diagrams and alloys, mechanical properties, material failure, corrosion, and introduction to the structures of polymers and ceramics.

EGEN583 Low Carbon Energy Technology (3 CH) (Pre-R: CVEN361)
This course introduces the fundamentals of low carbon energy technologies. Low carbon energy technologies for sustainable energy systems investigation, and examination. Economic consideration of law carbon energy. Challenges of low carbon energy systems.

EGEN573 Nuclear Energy (3 CH) (Pre-R: CVEN361)
This course introduces basic physics of nuclear energy and radiation, with an emphasis on the unique attributes and challenges of nuclear energy as a low-carbon solution. The course will explore fission energy, establishing the scientific, engineering, and economic basis for fission reactors, and will describe the state of the art in nuclear reactor technology.

EGEN575 Energy Buildings (3 CH) (Pre-R: CVEN361)
This course provides an introduction to energy in buildings and advancing energy efficiency in buildings. The course covers the essential technical, principles, design, polices of building energy. Energy building heat transfer and the required energy to control the temperature. efficient energy of buildings is a foundation of sustainable and healthy society. building Heating, Ventilating, and Air-Conditioning.

EGEN577 Waste and Energy (3 CH) (Pre-R: CVEN361)
This course discusses the basic of waste, energy and their sources. Environmental effects of energy development using fossil and fossil fuels, geothermic, photosynthesis, and other sources. Relationship of elemental cycles to the life supporting systems. Generation of energy from waste. biofuels and bio-resources.

EGEN584 Air Pollution and Control (3 CH) (Pre-R: CVEN361)
This course discusses the basic of air pollution and their sources. Topics covered include measurement techniques, physical, chemical and biological effects on ecology. Common air pollution in the Middle East, and their sources. Transport, dispersion and diffusion of air pollutants. Air pollution control processes. Constraints (economic, environmental, political, ethical and sustainability) in selecting air pollution technologies. Air pollution control legislation and Kyoto Agreement.

EGEN588 Digital Systems (3 CH) (Pre-R: EGEN221)
The objective of this course is to equip students with the fundamental knowledge and skills required to understand, analyze, and design digital circuits like combinational and sequential logic circuits for the real world. This course enables students to understand the elements of digital system such as numbering systems, digital logic, Boolean algebra, design of combinational logic circuits and finite state machines (FSMs).

EGEN522 Energy Economics (3 CH) (Pre-R: MATH204)
This course covers topics such as introduction to energy economics, energy data, investment and profitability calculation, energy demand, economics of energy supply and sustainability, energy market, energy pricing, economic analysis of energy systems.

EGEN579 Energy Selected Topics (3 CH) (Pre-R: CVEN361)
This course discusses specific topic related to energy engineering. The topic that will be discussed in the course may be an emerging development topic in energy engineering or of interest to the students. The content of the course could be changed as required.

EGEN559 Energy Audit and Management (3 CH) (Pre-R: CVEN471)
This course will introduce energy management, energy management opportunities and energy audit. Topics that will be covered in this course include evaluation of peak demand control, energy management opportunities in electrical systems and HVAC systems, cogeneration system and economic analysis of energy projects.

EGEN511 Biofuel, Geothermal, & Biomass (3 CH) (Pre-R: CVEN361)
The course is designed to teach students about biomass and biofuels. The course explains the biomass and biofuels resources and their composition. Introduction to geothermal energy systems. Biofuel's technologies (thermochemical, biochemical conversion, and supercritical water). Algae and biodiesel methods. Biomass energy techniques. Environmental and economic assessments.

EGEN372 Tidal and Wave Energy (3 CH) (Pre-R: EGEN201)
This course introduces the basic concept of power quality including terms and definitions, voltage sag and interruptions, voltage transient, harmonics and their solutions. It aims to understand power quality basics and related issues which involves identification of problem sources. Design different methods to analyze harmonic distortion, and quality of power systems. Purpose solutions of power quality problems and mitigation.

EGEN501 Power Quality (3 CH) (Pre-R: EGEN344)
This course introduces the basic concept of power quality including terms and definitions, voltage sag and interruptions, voltage transient, harmonics and their solutions. The course aims to understand power quality basics and related issues which involves identification of problem sources. Design different methods to analyze harmonic distortion, and quality of power systems. Purpose solutions of power quality problems and mitigation.

EGEN502 Power System Protection (3 CH) (Pre-R: EGEN344)
This course starts by introducing fault analysis, and different types of protective relays. Then the course discusses basic schemes of relaying protection for different components of power systems which includes feeders, transformers, transmission lines, generators, and motors.

University Electives (Choose two courses of 6 CH)