

**AGRİ İBRAHİM CECEN UNIVERSITY**

**VOCATIONAL SCHOOL**

**Department of Electricity and Energy**

**Technology of Alternative Energy Sources Curriculum and Course Contents**

**I.SEMESTER**

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| **Basic Energy Resources** | Classification of conventional energy sources and renewable energy sources. General comparison of conventional and renewable energy sources. General knowledge about solar energy and solar power systems. Knowledge about wind energy and wind energy conversion systems (wind turbines) and theoretical determination of performance of wind turbines applying momentum theory. Hydraulic energy and power generation systems for hydraulic sources. Knowledge about the formation of geothermal energy geothermal cells and power generation from this source. Prediction methods of the amount of heat obtainable from any geothermal source. Wave energy and wave energy conversion systems |
| **Basic Physics** | Physical quantities and calculations, static, dynamic, work energy, power, energy converters and efficiency calculations |
| **Measurement Technique** | What is Measurement, How to do, The importance and definition of measurement, Measurement Tools and Measurement Errors, Length, Area, Volume and Weight, Fluidity and Temperature Measurements, Slope, Cross Section and Diameter, Speed and Rotation, Sound, Pressure, Units of Measurement and Conversions, Tension Current, Power and Energy Measurement |
| **Mathematics-I** | Numbers, Algebra, Equations and Inequalities, Functions, Trigonometry, linear and exponential equations, Complex Numbers, Logarithm, statistics and reliability. |
| **Computer-I** | History of the computer, Operating system of computer, Equipment of computer, Operating system of DOS, Viruses of computer, Operating system of Windows and accessories, Word, Exel, Power point, Internet and use of internet. |
| **Foreign language-I** | Speaking, Listening-Understanding, Writing, Reading-Understanding |
| **Turkish Language-I** | Language, Languages and Turkish Language, Grammar, Word and Sentence, Types of Words, Elements of Expression and Types of Expression, Basic Principles of Proper and Effective Speaking |
| **Atatürk's Principles and History of Turkish Revolution-I** | Historical concepts, descriptions, descriptions of resources and methods, French Revolution and Industrial Revolution, Collapse of the Ottoman Empire, Tanzimat and Islahat Firman (order) , I. and II. Constitutional Monarchy, Tripoli and Balkan Wars, I. World War, Mondros Truce, Wilson principles, Paris Conference, Atatürk, Samsun and Anatolia, Amasya Notice, National Congress, Opening the Mebusan Assembly, Foundation of Turkish National Assembly (TBMM) , Internal rebellions, 1921 Organic Law, Foundation of the Army, I. Inönü, Sakarya, Kütahya, Eskişehir Wars and the Last Attack, Pacts during the Turkish War of Independence, Lozan Pact, Abrogate of Saltanate |
| **ELECTIVE COURSES** |  |
| **Contact** | Communication and Interpersonal Communication, Perception of Person, Verbal Messages, Nonverbal Messages, Listening, Interpersonal Communication and Ethical Principles, Relationship / Interaction Process, Interaction Contexts, Changing Relationships, Communication with Family and Friends, Communication in Close Relationships, Barriers to Communication, Conflict and Reconciliation, Cultural Differences and Communication |
| **Occupational health and Safety** | Occupational Health and Safety Historical Development of Occupational Health and Business Purpose and Importance of Safety Health and Concepts of Health in Turkey in the Safety Area and Safety of Overview of Job Accidents Occupational Diseases Occupational Accidents and Occupational Be Taken Against Disease Precautions Work Accidents and Occupational Diseases of nature costs |
| **Life Skills and Social Activity** | Self-realization, self-knowledge, communication, factors that hinder communication, social skills, saying no, problem solving, self-manifestation, anger, stress, excitement, anxiety and fear, etc. coping with challenging emotions, healthy decision making, public speaking, self-concept, career and career planning, cv preparation, efficient studying, aggressive and entrepreneurial behavior development, emotional intelligence. |
| **University and Career Success** | Career management and conceptual framework, career management process, tools and practices that form the organizational dimension of career development, career cycles of employees, career problems and solutions will be discussed. |

**II.SEMESTER**

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| **Introduction to Energy Physics** | At the end of this course, Student can apply ? Unit Systems,Vectors, ? Force, Frictional Force, ? Work, Power, Energy (Kinetic and Potential Energy Concepts), ? Fundamentals of Electric and Magnetic Fields, ? Circuit Elements Current - Voltage Characteristics and Properties, ? Properties of Diodes, Direct and Alternating Currents Conversion of Each Other, The Wave Properties, Waves Reflection and Refraction,Nuclear Energy, Fluid Mechanic |
| **Basic Electricity** | Input to electrical circuits Voltage Current Sources and Connections Kirchhoff Laws Thevenin Theory Norton Theory Superposition theorem Node voltages method Environmental currents method Work, Power, Energy, Efficiency Transformers Resistors Capacitors Semiconductors (Germanium, Silicon ...), Transistors |
| **Radiation and Protection Methods** | Radiation conservation philosophy. Basic security standards,  External and internal irradiation, protection methods,  Radiation protection of employees, radiation quantities, dose  calculations (x, gamma, alpha, beta and neutron), dose limits  Armoring principles, armoring principles of different medical systems |
| **Mathematics-II** | Linear Equation Systems and Matrices, Limits and Continuity, Derivatives and Applications, Integrals and Applications, Differential Equations, Statistics |
| **Turkish Language-II** | Types of Written and Oral Expression, Punctuation and Spelling Rules, Expression Disorders |
| **Atatürk's Principles and History of Turkish Revolution-II** | Republic History, Fundamental Properties of the Republic, Ataturk's Principles and Revolutions |
| **Computer-II** | Internet access and Internet browser, E-mail Management, News Groups / Forums, Web-Based Learning, Personal Web Site Preparation, Electronic Commerce, Word Processor Program, Curriculum Vitae, Internet and Career, job interview preparation, Exam Spreadsheet Formulas And Functions, Graphs, Presentations Preparation, Preparation of promotional material |
| **Foreign language-II** | Speaking, Listening Comprehension, Writing, Reading Comprehension |
| **Digital Literacy**  **ELECTIVE COURSES** |  |
| **First aid** | General First Aid Information, Crime Scene Management, Systems and Patient Injury Assessment, Basic Life Support in Adults, Basic Life Support in Children and Babies, Airway Obstructions, First Aid in Hemorrhages and Injuries, First Aid in Consciousness Disorders, First Aid in Burns, Freezing and Heat Strokes. First Aid in Poisoning and Animal Bites, Foreign Body Escape in the Ear and Nose, First Aid in Broken Dislocations and Sprains, Patient Injured Transport Techniques |
| **Entrepreneurship** | Entrepreneurship Concept and Its Emergence, Small Business Types, Small Business Establishment Processes, Small Business Problems and Solutions, Business idea development Methods of creating business ideas, mind maps, organizing and ordering ideas Decision in a business idea, market research, surveys and analysis, competitor analysis SWOT analysis Cost analysis and marketing for entrepreneurs Preparing business plan Business organization and grant-making organizations Application form and application guide reading techniques, Entrepreneurship Approaches, Entrepreneurship Culture, Entrepreneurship Types, Entrepreneurship Functions, Entrepreneurship Areas, Entrepreneurship Process, Business Ideas and Resources, Business Idea Development, Business Plan and Elements, Business Plan Preparation, Local, National and International Context of Entrepreneurshi |
| **Environmental Protection** | Environmental Definitions, Environmental Problems, Environmental Protection Measures, Nature Pollution, Noise, Environmental Regulation Information Risk Analysis, Waste Storage, Personal Protection Measures International Health and Safety Alerts |
| **Professional Ethics** | Ethical and moral concepts, Factors that play a role in the formation of morality, Ethical systems, Professional ethics, Professional corruption and consequences of unethical behavior in professional life, Social responsibility |

**III.SEMESTER**

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| **Thermodynamics and Heat Transfer** | Thermodynamic Variables, Thermodynamic Laws, Thermodynamic Potentials, GasFluid Power Cycles, Steam Power Cycles, Refrigeration Cycles, Heat Transfer Types(Conduction, Transport, Radiation), Heat Transfer Analysis, Conduction, Transport and Radiation Types of Heat  Transfer Applications, Heat Pump Elements and Calculation Principles, Heat Sources andComparative Analysis, Fluids Used in Heat Pump, Geothermal and Natural Gas HeatPumps, Heat Pump System Schematics and Analysis |
| **Solar Energy and Systems** | Planning of residential solar heating systems with this course, selection and installation of components, installation, maintenance and repair can be made installation of the control system |
| **Geothermal Energy and Systems** | The course is a technical elective course for energy engineering degree. The course covers thermal structure of the earth, heat transfer, geothermal systems and resources, exploration techniques, thermal energy of the oceans. |
| **Electricity Generation by Hydro Energy** | Hydroelectric power plant groups Energy calculation in the dam Units of hydroelectric power plants Units of hydroelectric power plants Dam types Turbine types Turbine materials Auxiliary units of power plants Electrical equipment Control rooms Parallel operation of power plants Economy Load power plants Electricity tariff applications |
| **Hydrogen Technology** | roperties of Hydrogen Gas, Hydrogen Production Methods, Basic Concepts About Hydrogen Energy, Hydrogen Storage, Hydrogen Transport Systems, HydrogenEnergySystems,HydrogenFuelCells,Hydrogen Fuel Vehicles |
| **Industrial Control and Engines** | Structure, properties and working principle of three-phase asynchronous motors, Equivalent circuits of three-phase asynchronous motors, Idle operation in three-phase asynchronous motors, short circuit and load operation, Starting speed control and braking in asynchronous motors, Single-phase motors, Synchronous generators and structure of synchronous motors working methods and principles, phasor diagram for inductive and capacitive loads in synchronous generators, parallel connection of synchronous generators, starting in synchronous motors, phase diagram in case of inductive capacitive and ohmic operation of synchronous motors, loading of synchronous mach |
| **ELECTIVE COURSES** |  |
| **Energy Conversion Systems** | Energy Conversion and Efficiency Concept, Combustion Based Technologies (Internal Combustion Engines, Gas Tribunes, Steam Tribunes, Catalytic Reactors), Non-Combustion Based Technologies (Fuel Cells, Biological Reactor, Solar Eyes, Water Tribunes, Wind Tribunes) |
| **Transmission Distribution and Compensation** | Recognition of energy transmission and distribution networks, Understanding of energy transmission and distribution networks, their features and operating conditions, control of LV and MV voltage conditions, Only field and transformer centers and transmission lines: recognize switching, protection and measurement elements, comprehend safe working rules, Compensation purpose and importance |
| **Boron Technology** | General information about inorganic boron compounds, sodium borates, dehydration and drying of Borax, Borax Production, Tincal from Borax Production in Turkey, anhydrous borax production, Boric Use and Features of Acid Production Methods, colemanite from Sulfate Acid With Boric Acid Production of Boron Compounds and Pipe Biological Properties, Environmental Pollution of Boron, Usage of Boron in Energy Field (Boron Solid Fuels, Sodium Borohydride Applications, Storage of Solar Energy, Solar Cell Protector |
| **Electric Power Transmission and Distribution** | In this course, it is aimed to introduce the materials of all kinds of high voltage networks and to gain competencies for the processes of their assembly. |
| **Energy Management and Policies** | General Energy Situation in Turkey and the world, of Policy Analysis of Legislation and Energy Policy, EU Energy Policies, Structure of Turkish Industry, Energy Consumption, Energy Management, Economic Analysis, Environmental, Energy, and Economic Growth, National and International Regulatory Authorities , Liberalization and Competition, Energy and Sustainable Growth |

**IV.SEMESTER**

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| **Nuclear Power Generation** | Basic Atomic Knowledge, Introduction to Nuclear Physics, Properties of Radioactive Elements, Energy Obtained  Reactions, Basic Operating Principles of Reactors, Radiation Protection |
| **Biomass Energy Production** | Introduction to Biomass Formation-Photosynthesis, Biomass Resources, Biomass Conversion Technology, Environmental Effects, Use of Biomass in the world, Biomass Usage in Turkey .. |
| **Wind Power Generation.** | The historical development of wind energy systems, Wind energy in Turkey and all over the world, Wind energy and its characteristic properties, Introduction to modern wind stands, The evolution of modern wind stands, Commercial wind stands and its applications, Aerodynamic manners of wind stands, Wing and fan structures of wind stands, Structural dynamic factors in the design of wind stands, Acoustics in wind stands. |
| **Energy Systems Design** | Energy Economy Fossil Fuel Electric Power Generation Plants  Renewable Energy Sourced Electric Power Generation Plants  Energy Conversion |
| **Advanced Technology Material Knowledge** | Materials and their classification, Material Selection, Metallic materials (Iron-based Engineering materials, Metallic materials (Non-Ferrous Engineering materials), Non-metal materials (Ceramics, Polymers, Composites), Production methods and comparison of materials, Surface treatments and heat treatments, Methods of changing material properties, Strength increasing methods applied to materials, Properties of materials; Technological Properties (Shapeability, Castability, Machinability, Weldability) and Physical Properties (Density, color, rigidity, hardness, thermal and electrical properties), |
| **Energy Storage** | Energy and Energy Storage Concept, Mechanical Energy Storage, Electricity and Magnetic Energy  Examples of Storage, Heat Energy Storage and Energy Storage |
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| **ELECTIVE COURSES** |  |
| **Semiconductor Physics** | Crystal lattice structures of solids; Introduction to quantum mechanics; physical meaning and applications of schrödinger wave equation; adaptation of the wave theory to atoms; energy band concept; electrical conduction in solids; hole concept; state density functions; Fermi-dirac probability distribution function; semiconductor in thermodynamic equilibrium; load carriers in semiconductors; pure semiconductor; doped semiconductor; load transmission phenomenon; drift and diffusion mechanisms; deviations from thermodynamic equilibrium and extra charge carriers; basic structure of the pn joint; pn junction in polarization in the direction of zero voltage, transmission and occlusion |
| **Hybrid Energy Systems** | It is aimed to introduce, structure, working principle and establishment of the systems where alternative energy sources can be used together and energy can be provided with others in the absence of one. In hybrid applications, it is possible to use solar, wind and diesel energy sources as double or triple. It is one of the objectives of the course to determine which energy sources will be used, especially according to the climate conditions of the region. |
| **Recycling Methods** | Waste Types, Industrial Waste Management, Industrial Waste Management Plan, Codes and Properties of Hazardous Waste, Recycling, Recovery of Plastic Materials, Environmental Risk Assessment and Management, Waste Reduction and Waste Rehabilitation Concepts, Waste Classification (Organic and Inorganic Waste Evaluation Methods), Waste Management Systems, European Union Recycling Guidelines |
| **Laser Application Techniques** | Principles of laser theory, CO2 gas and fiber lasers, two and three dimensional laser machines, laser  cutting, welding, coating, alloying, bending, heat treatment, laser cleaning and etching,  direct metal laser sintering, material shaping with laser beam, laser prototyping, laser  used in machine tools, mirror and lens cleaning, optical settings, laser benches  CAD-CAM programs, laser applications on ceramic, polymer and textile materials,  femtosecond laser machine and applications. |
| **Energy and Environment** | Environmental Regulation Information, Risk Analysis, Waste Storage, Personal Protection Measures, International Health and Safety Alerts, Occupational Health and Safety Regulation |
| **Common Elective Course** |  |