Sustainability Courses

|  |  |  |  |
| --- | --- | --- | --- |
| Title | Department | Level | Description |
| Electrochemistry for Renewable Energy Applications | Natural Sciences | UG |  |
| Sustainable Human Ecology | Natural Sciences | UG |  |
| Klamath Bioregional Studies | Natural Sciences | UG | The Klamath River Bioregion from an integrated ecological perspective. Team project in assessing current socioeconomic, cultural and ecological conditions in the bioregion and developing management strategies for sustainable resource use. |
| Ecotourism | Management | UG | Study of sustainability principles as they apply to tourism and hospitality industry. Topics include the ecotourism environment, the economic sociological and cultural impacts of ecotourism, ecotourism as a business and a world survey of ecotourism sites. |
| Sustainability and Infrastructure | Civil Engineering | UG |  |
| Introduction to Engineering I | Electrical Engineering & Renewable Energy | UG | A three course sequence introducing the field of engineering, focusing on electrical engineering and renewable energy. |
| Introduction to Engineering II | Electrical Engineering & Renewable Energy | UG | A three course sequence introducing the field of engineering, focusing on electrical engineering and renewable energy. |
| Introduction to Engineering III | Electrical Engineering & Renewable Energy | UG | A three course sequence introducing the field of engineering, focusing on electrical engineering and renewable energy. |
| Environmental Social Sciences | Natural Sciences | UG | An introduction to the integration of science, social systems, environmental policy, and sustainability focusing on types of data, sampling techniques, and statistical methods used by social scientists. Emphasis on active learning and case study approaches. |
| Watershed Science & Technology | Natural Sciences | UG | Science and technology of watershed processes, monitoring, and assessment. Applications and case studies focused on sustainable management and restoration of water resources and their associated aquatic, riparian, and upland ecosystems. Local and regional sites of interest are highlighted. |
| Greenhouse Gas Accounting/Footprints | Natural Sciences | UG | Course topics include US and international greenhouse gas (GHG) management policies. GHG assessment methods and tools, emissions trading programs, climate risk and risk management, data and information sources, measurement standards and protocols and related sustainability concepts and policies. |
| Greenhouse Gas Accounting/Footprints | Electrical Engineering & Renewable Energy | UG | Course topics include US and international greenhouse gas (GHG) management policies. GHG assessment methods and tools, emissions trading programs, climate risk and risk management, data and information sources, measurement standards and protocols and related sustainability concepts and policies. |
| Land Administration for Sustainable Land Development | Management | UG |  |
| Fundamentals of Renewable Energy Management | Management | UG |  |
| Introduction to Renewable Energy | Electrical Engineering & Renewable Energy | UG |  |
| Materials for RE Applications | Electrical Engineering & Renewable Energy | UG | Electrical, mechanical, thermal, chemical, optical, and processing properties of materials in renewable energy systems; solid-state device characteristics and their material properties. Engineering applications. |
| REE Senior Project I | Electrical Engineering & Renewable Energy | UG | Selection, definition, and analysis of a problem suitable for a renewable energy engineering senior project prior to actual development. Includes consideration of project parameters, and implications, proposal of alternate solutions, and justification of selected solution Culminates in the writing of project proposal. |
| REE Senior Project II | Electrical Engineering & Renewable Energy | UG | A continuation of REE 339. Prototype construction of project solution begins. Writ­ten documentation is produced including design calculations and functional analysis of hardware and/or software needed for project solution. |
| REE Senior Project III | Electrical Engineering & Renewable Energy | UG | Completion of the project proposed in REE 339 and designed in REE 449. Documenta­tion with specifications, functional descrip­tion, calculations, test results, schematics, graphs, charts, parts lists, diagrams and photographs become part of the project final report. The student defends their project before a review panel. |
| Electric Power Conversion Systems | Electrical Engineering & Renewable Energy | UG | Power electronics devices in renewable energy applications, including converters and controls. Project integral to class. |
| Power System Analysis | Electrical Engineering & Renewable Energy | UG | Faults: symmetric, unsymmetric. Modeling system components using positive, negative, zero consequence networks. System admittance matrixes. Load flow computational methods such as Gauss-Seidel, Newton-Raphson. Power system stabilization. Power system analysis using software, emphasizing renewable resources. |
| Power System Analysis | Electrical Engineering & Renewable Energy | G | Faults: symmetric, unsymmetric. Modeling system components using positive, negative, zero consequence networks. System admittance matrixes. Load flow computational methods such as Gauss-Seidel, Newton-Raphson. Power system stabilization. Power system analysis using software, emphasizing renewable resources. |
| Power System Protection and Control | Electrical Engineering & Renewable Energy | UG | Protection systems overview; protective devices; coordination and sequencing of relays; grounding practices; impedance protection. Methods of power systems operation and control; load-frequency control, automatic generation control. Modeling power systems protection and control using power system analysis software, emphasizing renewable resources. |
| Power System Protection and Control | Electrical Engineering & Renewable Energy | G | Protection systems overview; protective devices; coordination and sequencing of relays; grounding practices; impedance protection. Methods of power systems operation and control; load-frequency control, automatic generation control. Modeling power systems protection and control using power system analysis software, emphasizing renewable resources. |
| Renewable Energy Transportation Systems | Electrical Engineering & Renewable Energy | UG |  |
| Grid Integration of Renewables | Electrical Engineering & Renewable Energy | UG |  |
| Grid Integration of Renewables | Electrical Engineering & Renewable Energy | G |  |
| Energy Engineering I | Electrical Engineering & Renewable Energy | G | Three-term sequence in energy engineering. For a variety of renewable and conventional means of energy production, storage, and distribution, students gain a robust understanding of resources, energy conversion technology, integration with existing systems, regulatory contexts, business environment, and future trends. |
| Energy Engineering II | Electrical Engineering & Renewable Energy | G | Three-term sequence in energy engineering. For a variety of renewable and conventional means of energy production, storage, and distribution, students gain a robust understanding of resources, energy conversion technology, integration with existing systems, regulatory contexts, business environment, and future trends. |
| Energy Engineering III | Electrical Engineering & Renewable Energy | G | Three-term sequence in energy engineering. For a variety of renewable and conventional means of energy production, storage, and distribution, students gain a robust understanding of resources, energy conversion technology, integration with existing systems, regulatory contexts, business environment, and future trends. |
| Sustainability of Energy Systems | Electrical Engineering & Renewable Energy | G |  |
| Utilization Strategies of Bioenergy | Electrical Engineering & Renewable Energy | G | Strategies for sustainable energy production from biomass. Direct combustion. Fermentation processes. Anaerobic digestion systems. Thermochemical processes; gasification, liquefaction. Chemical synthesis pathways. |
| Costing Renewable Energy | Electrical Engineering & Renewable Energy | G |  |
| Renewable Energy Integration | Electrical Engineering & Renewable Energy | G |  |
| Introduction to Sustainability | Humanities and Social Sciences | UG |  |
| Wind Power | Electrical Engineering & Renewable Energy | UG | Introduction to power production from wind resources. Historical uses of wind resources. The Earth’s wind systems. Physics of wind power. Vertical and horizontal axis turbines. Aerodynamics of wind turbines. Large-scale turbine farms and sighting. Commercial development, economics and environmental impacts. |
| Biofuels and Biomass | Electrical Engineering & Renewable Energy | UG | Introduction to power production from biomass resources. Historical uses of biomass resources. Biomass as a solar energy store; forestry and agricultural sources, crop wastes. Recycled sources; municipal solid wastes, landfill gas. Gaseous fuels; anaerobic digestion, gasification, liquid fuels, fermentation, hydrolysis, transesterfication. |
| Hydroelectric Power | Electrical Engineering & Renewable Energy | UG | Introduction to hydro-resource power production. Hydro-power in history. Physics of hydrology. Power, head, flow-rate. Turbine hydrodynamics; Francis, Kaplan, Pelton, Turgo, cross-flow. System components: generators, governors, penstocks, spillways, valves, gates, trashracks. Large-scale and microhydroelectric systems. Pumped storage. Economic, environmental considerations. |
| Solar Thermal Energy Systems | Electrical Engineering & Renewable Energy | UG | Introduction to solar thermal energy systems for residential, commercial and industrial applications. Solar radiation; topics in heat transfer; flat plate and concentrating col­lectors; non-imaging optics; applications including water heating, building heating, cooling, industrial process heat, distillation, solar thermal power systems. |
| Photovoltaic Systems | Electrical Engineering & Renewable Energy | UG | The solar resource, sun charts, site assess­ments. Grid-connected and stand-alone systems. Module and array performance. PV system components including batteries, modules, charge controllers, maximum power point trackers, inverters. Economic consid­erations including investment tax credits, present-value analysis, IRR. Advanced PV materials. |
| Geothermal Heat Pump Design | Electrical Engineering & Renewable Energy | UG | Theory/design of geothermal heat pump applications, emphasis ground heat exchanger simulation and design. Closed-loop, open-loop, and hybrid geothermal heat pump systems will be exam­ined. Exposure to the development and use of geothermal design and simulation tools. |
| Geothermal Energy and Direct Use Application | Electrical Engineering & Renewable Energy | UG | Introduction to basic geothermal energy sources and generation. Basic geothermal energy applications including direct use, heat pumps and power generation. Geothermal reservoir, site analysis, exploration and drill­ing. Direct use application system design (HVAC) and equipment. |
| Geothermal Power Plant Design | Electrical Engineering & Renewable Energy | UG | Introduction to geothermal reservoir pres-sure, temperature and flow models and analy-sis. Basic geothermal power plant equipment and design for dry steam, single/double flash and binary cycle power plants. Plant thermo-dynamic analysis/efficiency using Rankine/ Kalina cycles. Plant environmental, economic and social impacts. |
| Production of Biomass and Biofuels | Electrical Engineering & Renewable Energy | G | The use of recently living plant or animal materials as sources of fuels, chemicals or industrial products. Sourcing and produc­tion. Biomass chemistry; lignocellulosics, fats, oils, saccharides, polysaccharides, proteins, and extractables. Chemical modification of biomass to produce fuels, polymers, indus­trial chemicals. |
| Hydrogen Production and Storage | Electrical Engineering & Renewable Energy | G | An overview of primary technologies, eco­nomic aspects, and social policy issues related to development of hydrogen systems and hy­drogen economy, including water electrolysis, reformer technologies, and hydrogen storage. |
| Solid-State Physics of Photovoltaic Materials | Electrical Engineering & Renewable Energy | G | Principles of PV; electrons and holes in semiconductors; junction analysis. Survey of available semiconductors and materials choices for photovoltaic design. Principles of important photovoltaic devices. Monocrystal­line, polycrystalline, and thin film solar cells. Strategies for high efficiency. Photovoltaic materials and phenomena. |
| Wind Power Generators | Electrical Engineering & Renewable Energy | G | Wind energy as a power source. AC ma­chines, particularly three-phase induction and synchronous generators for wind power gen­eration. Equivalent circuit models. Wound-rotor, permanent magnet, multi-pole, and switched-reluctance generators. Power and torque control. |
| Ground-Source Heat Pumps | Electrical Engineering & Renewable Energy | G | Heat pump design and operation. Heat pump cycles. Refrigerant selection. Ground-loop design. Heat transfer issues pertaining to geothermal energy. System design and integration. Temperature and materials issues unique to geothermal heat pumps. |
| Hydraulics & Fluid Mech. Of Hydropower | Electrical Engineering & Renewable Energy | G | Open-channel hydraulics, including wa­tershed hydrology, sediment transport and bed load movement, reservoirs, hydrostat­ics, dredging, spillways, stilling basins, and hydraulic jumps. Advanced fluid mechan­ics. Types of turbines. Modeling and unit optimization. Background in fluid mechanics required. |
| Applied Photovoltaics | Electrical Engineering & Renewable Energy | G | The characteristics of sunlight. Solar cell be­havior, properties, and design. Cell intercon­nection and module fabrication. Designing stand-alone and grid-connected photovoltaic systems. Special-purpose photovoltaic ap­plications. Concentrator and hybrid solar thermal and photovoltaic systems. Advanced photovoltaic systems. |
| Electric Power Conversion | Electrical Engineering & Renewable Energy | G | Electric power conversion for wind genera­tors. Review of power switching devices. Rectifiers, DC-DC converters, inverters. Pulse-width modulation. Converter topolo­gies. Doubly-fed induction generators. Reac­tive power compensation. |
| Advanced Geothermal Energy | Electrical Engineering & Renewable Energy | G | Classification of geothermal resources. Basics of geothermal wells and drilling. Resource capacity estimation and measurement. System design and integration. Applications such as aquaculture, greenhouses, and district heating. |
| Development of Hydropower Projects | Electrical Engineering & Renewable Energy | G | Mechanical and electrical equipment, including flow control elements, generators, transformers, protection and control equip­ment, and governors. Transient responses and stability. The engineering, procurement and construction process for hydropower projects. Commissioning and documentation. |
| Process Design and Economic Evaluation for Biomass Energy Systems | Electrical Engineering & Renewable Energy | G | Process engineering methods, including development of process and instrumentation diagrams (P&ID); equipment selection and sizing; cost estimation, economic evaluation; and, fundamentals of chemical process safety. |
| Wind Energy Systems Integration | Electrical Engineering & Renewable Energy | G | Wind system electric power integration, protection, and control. System components, including generators, transformers, and switching stations. Network stability. Energy sector regulation and markets. Forecasting and integration of wind power systems. |
| Geothermal Power Generation | Electrical Engineering & Renewable Energy | G | High-enthalpy resources suitable for electric power generation. Energy transfer and conversion. Plant design and integration. Advanced design such as absorption power cycles. |
| Transportation Fuel Cells | Electrical Engineering & Renewable Energy | G | Detailed assessment of advances, prospects, and economics of polymer electrolyte mem­brane fuel cell, operational characteristics, durability, manufacturing, and fuel storage options in the automotive applications. |
| Energy Storage Fundamentals | Electrical Engineering & Renewable Energy | G | The survey course will examine energy stor­age fundamentals; applications and trends for pumped hydro, compressed air, flywheels, superconducting magnetic energy storage, gravitational mass, supercapacitors, batteries, fuel cells, and thermal systems. |
| Economic, Regulatory, and Environmental Aspects of Hydropower | Electrical Engineering & Renewable Energy | G | Duration curves and generation studies. FERC permitting and licensing, includ­ing compliance. Power sales contracts and bundled services. Environmental impact assessments. Project financing, management, and operations requirements. Optimization of integrated hydropower systems. |
| Global Population Health | Humanities and Social Sciences | UG | Introduces demographic methods and theories of population health, in addition to trends in fertility, mortality, morbidity, and aging both in the U.S. and internationally. |
| Globalization | Humanities and Social Sciences | UG | Addresses what globalization is and how it developed and spread. Benefits and harms of globalization in the areas of work, culture, warfare, national sovereignty, health and food. Countervailing pressures from social movements will be examined. |
| Introduction to Environmental Sciences | Natural Sciences | UG | A topical overview of environmental sciences stressing the integration of the social, natural and physical sciences. Emphasis on active learning. |
| General Ecology | Natural Sciences | UG | An examination of ecological principles applied to microhabitats, habitats and ecosys­tems. Includes community ecology, popula­tion ecology and resource analysis, supple­mented by regional and local field exercises with training in measurement and collection of ecological components. |
| Aquatic Ecology | Natural Sciences | UG | Aquatic ecosystems, patterns of development, population dynamics, diversity and energy cycles in marine and freshwater communi­ties. Local and extended one- or two-day field trips to study different ecosystems off-cam­pus. Procedures for sampling, data collection, numerical modeling and simulation studies of aquatic pollutants. |
| Environmental Regulation | Management | UG | Legislation and enforcement activities involv­ing natural and industrial environments. Conservation laws, land use and planning, responsibilities of regulatory agencies, review of current legislative actions and judicial decisions. |
| Environmental Management | Management | UG | Review of contemporary management issues and business practices related to land use management and planning, ecological plan­ning, environmental quality engineering and control and natural resource economics. |
| Environmental Engineering I | Civil Engineering | UG | Introduction to environmental engineering principles, fundamental concepts and supporting calculations. Physical, chemical and biological elements of the natural environment. Environmental impacts of anthropogenic activities. Control and pollution prevention technologies. Legal and regulatory framework governing environmental management. |
| Environmental River Mechanics | Civil Engineering | G | River response to watershed modification and infrastructure, including introduction to fluvial geomorphology, sediment transport and stream restoration. Management of waterways and floodplains. |
| Environmental Remediation Technologies | Civil Engineering | G | Potential human activity effects on natural systems (air, soil, water). Physical, chemical, and biological processes in contaminant fate and transport. Regulatory aspects of environ­mental assessment, monitoring, and prioriti­zation. Remediation/restoration technologies and strategies. |
| Environmental Chemistry and Toxicology | Natural Sciences | UG | Mechanisms and toxicological effects of chemical reactions in water, soil and air. Global and regional concerns about atmo­spheric and marine contaminants, thermal pollution, pesticide and heavy metal disposal, radioisotope properties and effects of pollut­ants on living organisms. Organic nomencla­ture and selected biochemistry principles. |
| Fate and Transport of Pollutants | Natural Sciences | UG | Mass balance. The use of equilibrium and chemical kinetics in the modeling of pollut­ant transport in water, soil and air. Mixing zone analysis, the use of Darcy’s law, flow nets and the Gaussian Plume approximation. Discussion, development and use of selected modeling scenarios. |
| Water and Wastewater Treatment Plant Design | Civil Engineering | UG | Planning, design, construction and operation of water and wastewater treatment systems. Prepare preliminary engineering design report. Work in design teams and present process designs for a potable water treatment plant and a municipal wastewater treatment plant. |
| Solid and Hazardous Waste Management | Civil Engineering | UG | Sources and characteristics of solid and hazardous wastes. Laws, regulations, methods and issues associated with the collection, han­dling, tracking, transportation, treatment and disposal of solid/ hazardous wastes. Material recovery and recycling, waste to energy, com­posting, design of landfills and environmental considerations. |
| Energy Economics and Policy | Humanities and Social Science | UG | Explores the role of energy and energy resources from the economic perspective. Analyzes U.S. and global energy markets and policy; traditional and alternative energy sources; pricing of externalities and public goods; the use of market instruments, subsi­dies and taxes; and the political economy. |
| Ecological Issues in Nature Writing | Humanities and Social Science | UG | Study of nature writers and the role of the environment in Western culture. Texts and authors will be studied from a literary studies perspective and a social justice perspective. |
| Introduction to Geothermal Energy | Manufacturing and Mechanical Engineering and Technology | UG | Overview of geothermal energy: distribu­tion, geology, hydrology, and geochemistry; exploration and extraction techniques; uses including power generation, space heating, agriculture, process and multistage utiliza­tion; and environmental, economic, and legal considerations. Field trips to local sites. |
| Passive Solar and Solar Cell Design | Manufacturing and Mechanical Engineering and Technology | UG | Residential passive solar heating and super-insulation construction techniques including heat load calculations using the Balcomb SHF method. Technical and economic analy­sis of solar electric cells, storage batteries, and inverter technology. |
| Environmental Management and Restoration | Natural Sciences | UG | Overview of legislative, regulatory, and public and private voluntary activities involving the management and restoration of natural ecosystems and their services. Emphasis on the National Environmental Policy, Clean Water, and Endangered Species Acts, with il­lustrative case studies from local and regional environments. |
| Systems Modeling | Natural Sciences | UG | Computer simulation of dynamic systems. Fundamentals of numerical simulation. Simulation of positive and negative feed-back loops. Examination of differing model approaches. Multiple independent variables. Randomness. Application towards ecological systems. |
| Environmental Microbiology | Natural Sciences | UG | Microbial processes with emphasis on soil and water habitats. The impact of microor­ganisms in health, water and food sanitation, waste disposal, and bioremediation. Micros­copy, laboratory, and field techniques for the isolation and identification of microorgan­isms. |
| Environmental Hydrology | Natural Sciences | UG | Study of the hydrologic cycle; quantitative measurement of precipitation, infiltration, runoff, streamflow and storage in watersheds. Curve fitting, hydrographic analysis, statisti­cal analysis of extreme flows, flood routing and runoff modeling for small and urban watersheds. |
| Atmospheric Physics | Natural Sciences | UG | The physics of transport and diffusion of air pollution. Atmospheric thermodynamics. Mixing heights, plume rise, and fundamen­tals of atmospheric turbulence. Eulerian and Lagrangian dispersion models. |
| Integrated Watershed Analysis | Natural Sciences | UG | Land use hydrology and watershed manage­ment practices to improve and maintain water quality. Emphasis on integrated, multi­disciplinary assessment methods. |
| Treatment Wetlands | Natural Sciences | UG | Treatment wetland features; biological, chemical and physical properties. Planning, design and performance assessment principles for municipal, agricultural and stormwater treatment wetlands. Considers vegetation and microbiology, aerobic and anaerobic biogeochemistry, hydraulics and treatment efficiencies. Local case studies. |
| Globalization and the Pacific Northwest | Humanities and Social Science | UG | This seminar addresses globalization in the PNW. Topics include colonialism, mercantilism, markets, imperialism, and cultural exchange. PNW industries involved in globalization such as timber, fishing, ag­riculture, tourism, and oil will be examined. Social movements and protests will also be considered. |
| Environmental Ethics | Humanities and Social Science | UG | Students will become familiar with influen­tial moral theories, including those of Kant and Aristotle and Utilitarianism. Possible topics include: What is nature? Do we have a moral obligation to restore ecosystems? If we have moral obligations to nature, on what grounds? |
| Water Quality Technology | Natural Sciences | UG | Examination of water quality relative to surface, groundwater and industrial sources. Focus on laboratory and field procedures for detection, surveillance and abatement of water pollution. |