Description: Graduates with a desire to work in fields of renewable energy including solar and wind, electric and hybrid electric vehicles, power supplies and UPS systems, pulsed power, and power systems need to have a good understanding of power converters and electric machines as well as strategies suitable for controlling them. Currently, there is a high demand for power electronic and power system engineers and is expected to grow very quickly in the near future. The ECE Undergraduate Office will strictly enforce prerequisites. Questions? Go to the Virtual Advising Center: vac.ucsd.edu

TO CHECK WHEN POWER ENGINEERING COURSES ARE OFFERED, GO TO ECE.UCSD.EDU/COURSES

POWER SYSTEMS ANALYSIS & FUNDAMENTALS [ECE 121A]
This course introduces concepts of large-scale power system analysis: electric power generation, distribution, steady-state analysis and economic operation. It provides the fundamentals for advanced courses and engineering practice on electric power systems, smart grid, and electricity economics. The course requires implementing some of the computational techniques in simulation software. PREREQUISITES: ECE 35

ENERGY CONVERSION [ECE 121B]
AC and DC machines are widely used in many modern energy conversion applications, including propulsion for hybrid-electric vehicles, electric vehicles, wind energy generation, and flywheel energy storage systems. Because of flexibility of controls offered by modern power electronic circuits, interest in electric machines is steadily increasing. Principles of electro-mechanical energy conversion, fundamental concepts of magnetic circuits, steady-state performance of dc and induction machines, and principals of synchronous motor and generators are covered under this course. PREREQUISITES: ECE 121A

POWER ELECTRONICS I [ECE 125A]
Power electronic circuits provide the means for efficient control & conversion of electric power through the use of solid-state switches. Applications of power electronics include switch mode power supplies, DC/DC and DC/AC converters, electric and hybrid electric drives, high voltage DC networks and renewable & hybrid generating systems among many others. This course provides a conceptual foundation for the analysis & design of power electronic circuits, covering principals of operation & control of AC/DC, DC/DC, and DC/AC converters. PREREQUISITES: ECE 121A

POWER ELECTRONICS II [ECE 125B]
Design and control of dc-dc converters, PWM rectifiers, single-phase and three-phase inverters, power management, and power electronics applications in renewable energy systems, motion control, and lighting will be presented. The intent of this course is to provide an adequate education for senior and graduate students on high-frequency power converters. Synthesis and analysis techniques will be developed through the study. Applications and advances of the high-frequency switching power converter in renewable energy and electric vehicles will be presented. PREREQUISITES: ECE 125A

EMERGING POWER GRIDS
This course provides practical coverage cross-disciplinary subjects on the emerging changes to the energy systems and smart grid. It includes subjects relating to energy resources, transmission, distribution, and delivery systems. It covers the practical aspects of the technologies, design, policies and implementation. Topics include: changing nature of transmission and distribution systems; smart grid applications and smart sensing; advanced metering infrastructure and energy management; microgrids
and distributed energy resources. It presents actual examples along with the lessons learned from them and best practices. **NO PREREQUISITES REQUIRED**

**POWER SYSTEM PLANNING & RELIABILITY**
This course introduces basic concepts that are commonly practiced in planning and reliability evaluation of power systems, considering NERC Reliability Standards, CAISO Tariffs, and CPUC Regulations. Topics Covered: Load Forecasting; Generation System Reliability Analysis; Generation System Cost Analysis; NERC Transmission Planning Reliability Standards, WECC and CAISO Planning Standards; Transmission System Reliability Analysis; Transmission System Expansion Planning; Some Regulatory Aspects of Power System Planning. **PREREQUISITES: ECE 121A**

**POWER SYSTEMS OPERATION & CONTROL**
This course introduces the basic concepts as well as analysis and optimization methodologies underlying reliable and economical operation and control of power systems. The topics include economic dispatch, unit commitment, linear and dynamic programming, fuel scheduling, hydrothermal coordination, optimal power flow, state estimation, and control of generation. It provides fundamentals for advanced courses in operational planning under electric energy market. The course requires implementing some of the computational techniques in simulation software. **PREREQUISITES: ECE 121A and174. ECE 121B recommended**

**REAL WORLD POWER GRID OPERATIONS**
This course provides practical insights into the operation of the power grid with the primary objectives of safety, reliability, and efficiency. It systematically describes the vital grid operator’s functions, the processes required to operate the system, and the enabling technology solutions deployed to facilitate the processes. **PREREQUISITES: None**

**RENEWABLE ENERGY RESOURCES & STORAGE**
This course provides a solid foundation to renewable energy resources such as solar (both photo- voltaic and concentrating solar power), biomass (conversions), wind power, geothermal, and hydro on distribution and transmission power systems. The class will explore the opportunities and challenges of integrating renewable energy sources into the conventional power grids in the USA and globally. It will present lessons learned from such applications from real life situations. **PREREQUISITES: ECE 35**