St. Albert's College (Autonomous)

An initiative of Archdiocese of Verapoly

Affiliated to Mahatma Gandhi University, Kottayam

(Accredited with "A" Grade by NAAC)

Programme Outcomes
Programme Specific Outcomes
Course Outcomes

Department of Renewable Energy

PROGRAMME OBJECTIVES (POs)

Knowledge & Comprehension: To develop in-depth apprehension about the subject and its allied realms by responsive and ceaseless process of learning. Also helps to understand renewable energy systems, its components and interactions between the components. This includes all renewable energy technologies, different storage technologies, distribution grid, and smart grid including sensors, regulation and control, both stand-alone systems and large integrated distribution systems.

Review: To develop a conscious for a review on utilization of trends in renewable energy resources

Productivity: To develop ability to channelize their acquired knowledge in a productive manner, able to design a subsystem in detail, able to conduct an independent, limited research or development project under supervision and in accordance with current research ethical standards in renewable energy systems.

Interpretation Skills: To develop a potential to construct interpretation of different forms of energy and to use identify, define, present and communicate issues within the subject area.

Research: To develop awareness about the prospect of exploration and research in the field of renewable energy and able to use laboratories and emulators of renewable energy systems to analyze relevant issues.

Social Consciousness and Ethical Excellence: To promote social expertise and improving peer interactivity and entitle them to treat everyone alike, to respect individual differences. To realize values such as equity, affection, honesty, faith and endorse ethical standards in all domains of life.

Teamwork and Communication Skills: To exhibit expertise in communication in groups and concerns, proficiency in dyadic communication and to possess adroitness to deliver presentations constructively.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

Analytical skills: To develop the ability to analyze the energy potential of renewable energy resources.

Critical thinking: To develop reasoning ability by inspecting and discussing the issues confronting and to react dynamically about them.

Designing: To develop ability to fabricate energy systems using renewable energy resources.

Social and Environmental responsibility: To develop the learner as a social being with major focus on the protection and feasibility of environment with sensitivity toward other beings. And will be aware of the importance of sustainable energy and develop renewable energy solutions to nurture human resources.

Applicability: To apply the acquired knowledge accurately in the renewable energy field in a productive and constructive manner. Excel with managerial and leadership qualities and also serve as trained man power in the field of Renewable Energy.

Technical Skills: To develop scientific and methodological skills to thrive it in the field of renewable energy

Correlation: To develop the ability to correlate different renewable energy resources by incorporating different disciplines and also able to analyze, design and provide solutions in the areas related to Solar Photovoltaics and Power electronics

COURSE OUTCOMES (COs)

CORE COURSES

COURSE 1- RENEWABLE ENERGY-I FUNDAMENTALS OF SUSTAINABLE ENERGY & DEVELOPMENT (REG1CRT01)

On completion of the course, the student should be able to understand the following:

- Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations.
- Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications
- Know the need of renewable energy resources, historical and latest developments

COURSE 2- RENEWABLE ENERGY-II: PHYSICO-CHEMICAL PROCESSES FOR WATER AND WASTEWATER TREATMENT (REG2CRT01)

On completion of the course, the student should be able to:

- Develop concern for water security
- Explain importance of drinking water and discharge standards
- Design basic water treatment process
- Identify and explain the main physical, chemical and biological processes for water and wastewater treatment

COURSE 3- RENEWABLE ENERGY-III: PHOTOVOLTAIC MODULE INSTALLATION (REG2CRT02)

On completion of the course, the student should be aware of the following:

- Explain how a solar cell converts sunlight into electric power
- Distinguish between PV cells, modules, panels and arrays
- Identify the five keys electrical output parameters for PV modules using manufacturer's literature and label these points on I-V curves
- Understand the effects of varying incident solar irradiance and cell temperature on PV module electrical output, illustrate the results on an I-V curve and indicate changes in current, voltage and power
- Explain the purpose and operation of bypass diodes

COURSE 4 –RENEWABLE ENERGY-IV: NOVEL RENEWABLE ENERGY SOURCES (REG3CRT01)

This course seeks to achieve the following:

- Understand position of hydrogen energy production and fuel cells in the nearest and distance future energy systems.
- Able to build the system model consisting of PV modules, hydrogen storage, PEM fuel cell and the resistive loads and simulate it using Simulink software.
- Analyze the features of MHD systems

COURSE 5– RENEWABLE ENERGY-V: SOLAR THERMAL TECHNOLOGY -I (REG3CRT02)

By the end of the course, the learner is able to

- Introduce the basic terminology including solar radiation, solar irradiance, solar irradiation, solar insulation, solar constant, solar altitude angle, solar azimuthal angle, solar window, array tilt angle, array azimuthal angle and solar incidence angle
- Identify the solar radiation measuring instruments
- Different types of Flat Plate Collectors and solar concentrators
- Applications of solar energy

COURSE 6 –RENEWABLE ENERGY-VI: WINDENERGY (REG3CRT03)

This course seeks to achieve the following:

- Critically evaluate different wind energy policy environments and analyze and critique the relative merits of alternative policy scenarios.
- Critically analyze key wind farm planning studies and explain the implications of the studies for wind farm development
- Understand the wind energy systems and design tradeoffs for the large components
- Identify problems and potential solutions associated with integrating high wind penetrations into the electric grid

COURSE 7- RENEWABLE ENERGY-VII: SOLAR THERMAL TECHNOLOGY-II (REG4CRT01)

On completion of the course, the student should be aware of the following:

- Understand the concept of heat transfer in flat plate collectors
- Understand the solar resource and be able to use this knowledge for testing and thermal analysis of flat plate collector
- Able to understand different types of evacuated tube collectors and thermal analysis of the same
- Able to conduct economic analysis and thereby to calculate the payback period

COURSE 8- RENEWABLE ENERGY-VIII: SOLAR PHOTOVOLTAIC ENERGY CONVERSION-I (REG4CRT02)

On completion of the course, the student should be aware of the following:

- Distinguish between PV cells, modules, panels and arrays.
- Understand the effects of connecting similar and dissimilar PV modules in series and in parallel on electrical output, and diagram the resulting I-V curves.
- Describe the components and the construction for a typical flat-plate PV module made from crystalline silicon solar cells, and compare to thin-film modules
- Describe the components and the construction for a typical flat-plate PV module made from crystalline silicon solar cells, and compare to thin-film modules

COURSE 9 - RENEWABLE ENERGY-IX: ENERGY STORAGE SYSTEMS (REG4CRT03)

On completion of the course, the student should be able to understand the following:

- Apply engineering fundamentals to design and implement electrical energy storage technologies such as hydrogen based systems and batteries to support sustainable energy solutions
- Model electrical energy storage systems when used in conjunction with sustainable energy solutions
- Discuss the scientific principles underpinning the operations of energy storage systems
- Demonstrate problem solving skills in energy storage engineering as a means of resolving intermittency of renewable energy sources such as solar and wind

COURSE 10 – RENEWABLE ENERGY-X: ENVIRONMENT, HEALTH AND SAFETY IN INDUSTRIES (REG5CRT01)

By the end of the course, the learner is able to

- Study and implement practical aspects of environmental protection and safety at work.
- Make sure that their activities do not cause harm to anyone.
- Understand the different types of safety problems and their sustainable solutions.

COURSE 11– RENEWABLE ENERGY-XI: PROJECT MANAGEMENT (REG5CRT02)

This course seeks to achieve the following:

- Conduct project closure activities and obtain formal project acceptance.
- Demonstrate effective organizational leadership and change skills for managing projects, project teams, and stake-holders.
- Conduct project planning activities that accurately forecast project costs, timelines, and quality.
- Implement processes for successful resource, communication, and risk and change management.

COURSE 12– RENEWABLE ENERGY-XII: ENERGY CONSERVATION TECHNIQUES (REG5CRT03)

By the end of the course, the learner is able to

- List several ways to conserve energy.
- Explain that energy in its various form ca affect everyday objects and is involved in everyday events.
- Describe remedies/potential solutions to the supply environmental issues associated with fossil fuels and other energy resources.

COURSE 13 – RENEWABLE ENERGY-XIII: SOLAR PHOTOVOLTAIC ENERGY CONVERSION-II OR SOLAR THERMAL TECHNOLOGY-III (REG5CRT04)

By the end of the course, the learner is able to

- Able to identify different types of solar cells.
- Analyze solar photovoltaic system energy and building resources.
- Compare and contrast solar photovoltaic system energy sources and applications.
- Explain the principles that underlie the ability of various natural phenomena to deliver solar energy.
- Outline the technologies that are used to harness the power of solar energy.
- Discuss the positive and negative aspects of solar energy in relation to natural and human aspects of the environment.

COURSE 14- RENEWABLE ENERGY-XV : ENERGY MANAGEMENT AND AUDITING(REG6CRT01)

On completion of the course, the student should be aware of the following:

- Understand the Indian energy scenario, energy policies, pricing and reforms.
- Understand the importance of implementing energy audits as part of energy efficiency and conservation exercise.
- Facilitate a platform for the implementation of energy saving measures based on the energy audit report outcome.
- Identify and analyze the quality of measuring instruments.

COMPLEMENTARY COURSES

COURSE 1- PHYSICS-I: UNITS AND MEASUREMENTS, CIRCUIT THEORY AND ELECTRICAL FUNDAMENTALS (RPH1CMT01)

On completion of the course, the student should be able to:

- Describe the circuit elements and characteristics: resistor, capacitor, inductor, voltage and current source
- Solve problems applying Ohms law, Kirchhoff's law and Maximum power theorem
- Able to explain the basic circuit concepts
- Recognize the difference between ac and dc and illustrate them diagrammatically

COURSE 2- PHYSICS-II: BASIC ELECTRONICS (RPH2CMT02)

This course seeks to achieve the following:

- Understand the current- voltage characteristics of semiconductor device
- Given information about a particular model of an atom, the student is able to determine if the model is consistent with the specific evidence
- Study the fundamentals of photoelectric properties of semiconductor materials and a wide variety of modern photoelectric devices

COURSE 3- CHEMISTRY-I: THERMODYNAMICS AND ELECTROCHEMISTRY (RCH1CMT03)

- Understand the relationship between cell potential and the equilibrium constant.
- Use cell potentials to calculate solution concentrations.

- Describe what information the First Law of Thermodynamics provides about the "directionality", or "tendency", of physical and chemical changes.
- Predict the sign of the entropy change for the system (ΔSsys) for physical and chemical changes.

COURSE 4- CHEMISTRY-II: PHYSICAL CHEMISTRY (RCH3CMT01)

On completion of the course, the student should be able to:

- Understand rate of reaction and factors affecting it. Understand theories of reaction kinetics and differentiate them.
- Explain what happens when organic molecules are excited by irradiation. Discuss the most important photochemical reactions for organic compounds.
- Identify and define various types of nuclear changes or processes including fission, fusion and decay reactions. Understand the concept of rate of change and half-life in the context of nuclear decay
- Describe the principles concerning solid state structures. Describe specific crystal structures by applying basic crystallographic concepts.

COURSE 5 – PHYSICS-III: THERMODYNAMICS AND FLUIDMECHANICS (RPH3CMT01)

By the end of the course, the learner is able to

- Introduce fundamental aspects of fluid flow behavior
- Able to apply Bernoulli's principle and compute pressure drop in flow systems of different configurations
- Able to describe function of flow metering devices and apply Bernoulli's equation to determine the performance of flow metering devices

COURSE 6- ENVIRONMENTAL EDUCATION (REG4CMT02)

On completion of the course, the student should be able to:

- Assess necessary scientific concepts while encountering environmental problems
- Prepare for employment and graduate studies in the analysis and mitigation of environmental problems

COURSE 7- MATERIAL SCIENCE (REG4CMT01)

On completion of the course, the student should be able to understand the following:

- Able to describe the basic structure of materials at the molecular microscopic and macroscopic scale
- Develop an understanding of the unique properties and characteristics of polymer based materials
- Able to optimize the thin film fabrication process to achieve the wanted properties

COURSE 8- PHYSICS IV: LASER AND OPTICAL INSTRUMENTATION (RPH5CMT01)

On completion of the course, the student should be able to:

- Describe the requirements for a system to act as a laser.
- Relate the structure and properties of lasers to this performance and intended applications.
- Assess which laser would best meet the need for a particular industrial/ research task.
- Demonstrate an awareness of the safety responsibilities involved in working with lasers.

COURSE 9- PHYSICS-V: SPECTROSCOPY AND EXPERIMENTAL TECHNIQUES (RPH6CMT01)

On completion of the course, the student should be aware of the following:

- Discuss the leak detection procedure in vacuum technology.
- Understand the recent advances in vacuum science and applications.
- Make aware of recent advances in NIR spectroscopy, x-ray photo electron spectroscopy.

COURSE 10- PHYSICS-VI: POWER ELECTRONICS (RPH6CMT02)

On completion of the course, the student should be able to understand the following:

- Describe the role of power electronics as an enabling technology in various applications such as energy conservation, renewable energy etc.
- Apply the theory and operating principles of electric machines to explain and evaluate their properties and characteristics when integrated into power system.
- Formulate and model power load flow problems, determine effective solutions to

the formulated problems and critically assess the performance of the determined solutions.

COURSE 11- RENEWABLE ENERGY-XIV: FUEL CELL SYSTEMS AND HYDROGEN (REG6CMT03)

On completion of the course, the student should be able to:

- Explain that a fuel cell uses the energy from the reaction of a fuel with oxygen to generate electricity and changes that takes place at each electrode.
- To make aware of the immediate market opportunities and challenges in fuel cell systems, and the current state of the art.
- To make aware of different types of fuel cells and fuel processing systems.
- To make aware of the different hydrogen production and storage techniques and increase the energy efficiency of production of hydrogen mainly from water electrolysis and renewable sources while reducing operating and capital costs.