SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS)

Reaccredited with B++ grade by NAAC

Affiliated to Periyar University

PG & RESEARCH DEPARTMENT OF PHYSICS

ADVANCED DIPLOMA COURSE

IN

RENEWABLE ENERGY MANAGEMENT AND AUDIT

Three -Year Course

Syllabi

I Year	**Certificate Course**	**Paper I - Fundamentals of Energy**
II Year	**Diploma Course**	**Paper II - Renewable Energy**
III Year	**Advanced Diploma Course**	**Paper III - Energy Audit and Management**

ADVANCED DIPLOMA COURSE IN RENEWABLE ENERGY MANAGEMENT AND AUDIT

Certificate Course: Fundamentals of Energy

Total Hours : 100 Hours

Syllabus

Objectives: Students will be able to understand the Fundamentals of Energy, Global Energy Scenario, Indian Energy Policy & Global Energy Policy

UNIT I: BASIC ELECTRICITY Hours: 20 Hours

Fundamentals of Electrical quantities -Electricity–current-volt-resistance-Power-Kilowatt-Capacitance-Inductance-Electrical charge-Electrical energy-Electric Potential-Grouping of Capacitors-capacitor in series –capacitors in parallel-Domestic Wiring Introduction-Industrial Wiring Introduction - Wiring materials –accessories - earthing -over loading –short circuiting-Fuses-Circuit breaker –Resistance Series circuit-parallel circuit-colour code.

Fundamentals of Electricity generation - Conventional power plant principle - Thermal, Hydel, Nuclear, oil and Gas.

UNIT-II: INDIAN ENERGY SCENARIO Hours: 20 Hours

Energy scenario-Primary Energy and Secondary Energy –Commercial Energy and Non-commercial Energy –Renewable Energy and Non-Renewable Energy- Conventional Energy and Non-Conventional Energy-Energy distribution in developed and developing countries. Indian energy scenario-sector wise energy consumption-Energy need of growing economy-Long term energy scenario in India-Energy pricing-Energy and environment-Evolutionary trends in pollution problems-climate change-Future effects-Energy conservation and its importance-Energy strategy for future

UNIT III-GLOBAL ENERGY SCENARIO Hours:20 Hours

Role of energy in economic development and social transformation - Energy and GDP - GNP and its dynamics-overall Energy demand and availability - Energy consumption in various sectors and its changing pattern - Depletion of energy sources and impact economics on international relations - Global Warming – Ozone layer depletion –Fossil Fuels.

UNIT IV: INDIAN ENERGY POLICY Hours:20 Hours

Policy Indicators – Per capita electricity consumption – Electrical intensity Global Energy Issues-National & State Level Energy Issues-National & State Energy Policy-Industrial Energy

Policy- Energy Security-Energy Vision-Energy Pricing and Impact of Global Variations-Energy Productivity (National & Sector wise productivity

UNIT V: GLOBAL ENERGY POLICY **Hours: 20 Hours**

International Energy Polices of G-8 Countries - G-20 Countries - OPEC Countries - EU Countries - International Energy Treaties (Rio, Montreal and Kyoto) - INDO-US Nuclear Deal- Future Energy Options-Sustainable Development-Energy Crisis-Role of International Energy Agency. Global energy consumption – Energy demand – primary energy demand and cumulative energy demand.

Books for study and reference

1. Basic Electrical, Electronics and Communication Engineering – S.ChenthurPandian (2000)
2. Mohan Munasinghe, Peter Meier. Energy Policy analysis and Modelling: Cambridge University Press1993

3. J. Goldemberg, T.B. Johansson, A.K.N. Reddy and R.H. Williams: Energy for a Sustainable World, Wiley Eastern, 1990.

4. World Energy Resources: Charles E. Brown, Springer 2002.

5. Resources, Charles E. Brown, 'International Energy Outlook' - EIA annual Publication

6. Principles of Energy Conversion: A.W. Culp (McGraw Hill International edition)

7. S Rao, Energy Technology, Khanna Publishers

Diploma Course : Renewable Energy

Total Hours: 100 Hours

Syllabus

Objectives: Students will be able to acquire knowledge about the Renewable Energy and its Applications.

UNIT –I: RENEWABLE ENERGY SOURCES Hours: 20 Hours

Primary energy Source-Secondary energy –Supplementary sources-Alternate energy strategy-Energy sources and their availability-Major sources like coal, water and nuclear. Basic Concepts – Renewable energy - Wind energy – Geo Thermal energy – Tidal energy – Ocean Thermal Energy Conversion(OTEC)-Hydrogen energy –Fuel cells.

ENERGY CRISIS, CONSUMPTION AND DEMAND Hours: 20 Hours

Introduction: Causes of energy crisis: Over consumption, over population, Infrastructure - Unexplored Renewable Energy Options – Commissioning of Power Plants. Moving toward renewable energy sources – energy conservation practices Technology up gradation and strategies to meet energy requirements.

UNIT-II: SOLAR ENERGY Hours: 20 Hours

Sun as source of energy –Solar constant –Solar Radiation at Earth's surface-Beam and diffuse Solar radiation-Sun at Zenith –attenuation of beam of radiation –Solar radiation –geometry-Local solar time –Solar radiation measurements –Pyrehiometer- Pyranometer-sun shine recorder-Solar radiation data-on titled surface-Calculation of angular diameter of the sun.

UNIT-III: SOLAR COLLECTORS Hours: 20 Hours

Solar energy collectors-Introduction Physical principles of conversion of Solar radiation into heat-flat plate collectors-typical liquid collectors-typical air collector application of solar air heaters-Advantages of flat plate collector-Energy balance equation and collector efficiency-

Solar energy storage –Introduction – solar energy storage systems- Thermal storage – Electrical storage-Chemical storage-mechanical energy storage-electromagnetic energy storage - Solar pond –basic principle –operation –applications.

UNIT- IV: APPLICATIONS OF SOLAR ENERGY **Hours: 20 Hours**

Introduction-Solar water heating systems-Space heating-Space cooling-Basic principle and technique-Solar distillation-Solar pumping-solar furnace-solar cooking-solar pumping-solar furnace solar cooking-design-principle-construction of Box type Solar cooking-Multireflectors type-Solar swimming pool -Advantages of greenhouse –Types of greenhouses-parameters for plant growth-Solar electric power generation-Solar photovoltaics-Solar cell principles-semiconductor junctions-conversion efficiency-and power output-basic photovoltaic system-for power generation-solar cell modules-applications-advantages and disadvantages.

UNIT-V: BIOMASS ENERGY **Hours: 20 Hours**

Energy from biomass –Introduction –Energy plantation-Photosynthesis-Photosynthetic efficiency-Biomass conversion technologies—thermochemical conversion-Fermentation-wet process-dry process-Biogas generation—Advantages of anaerobic digestion –factors affecting bio-digestion-Classification of biogas plants-Continuous-and batch –Dome & drum type-Different variations in drum type-Advantages and disadvantages. Commonly used biogas plants in India-Janta type –Deen bhandhu biogas type-KVIC-Pragati design biogas plant-Biogas from plant waste -Materials used for Biogas generation-Selection of site for biogas plant.

Books for study and Reference

1. Kothari P, Singal K C and RakeshRanjan, “Renewable Energy Sources and Emerging Technologies”, PHI Pvt. Ltd., New Delhi, 2008.
2. Sukhatme S P and Nayak J K, “Solar Energy - Principles of Thermal Collection and Storage”, Tata McGraw Hill, 2008.
3. Rai G D, "Non Conventional Sources of Energy", Khanna Publishers, 2006.
4. Bent Sorensen, “Renewable Energy”, Academic Press, 2004.
5. Abbasi S A and Naseema Abbasi, “Renewable Energy Sources and their Environmental Impact”, PHI Private Limited, 2001.

Advanced Diploma Course : Energy Audit and Management

Hours : 100 Hours /Year

Syllabus

Objectives: Students will be able to comprehend the knowledge of Energy Management & Energy Audit

UNIT- I: THERMAL ENERGY MANAGEMENT Hours: 20 Hours

Energy conservation in boilers - steam turbines and industrial heating systems – Furnaces - Application of FBC - Cogeneration and waste heat recovery - Thermal insulation - Heat exchangers and heat pumps – Best Practices in Building Energy Management and conservation – Green Building

UNIT- II: ELECTRICAL ENERGY MANAGEMENT Hours : 20 Hours

Electrical Distribution system – Power Quality - Supply side Methods to minimize supply-demand gap - Renovation and modernization of power plants – Maximum Demand - Reactive power management & Power Factor - HVDC Conservation in motors - Pumps and fan systems – Conservation in Compressed Air System – Cooling Tower – Lighting System - Energy efficient motors.

UNIT- III :ENERGY MANAGEMENT Hours:20 Hours

Design of Energy Management Programmes - Development of energy management systems – Importance - Indian need of Energy Management - Duties of Energy Manager - Preparation and presentation of energy audit reports - Some case study and potential energy savings.

UNIT- IV :SAFETY AND IMPACT ANALYSIS IN ENERGY INDUSTRIES Hours:20

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. Techniques: Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

Energy Conservation Act-2001 and its features - Electricity Act – 2003 and its features - Framework of Central Electricity Authority (CEA), Central & States Electricity Regulatory Commissions (CERC & ERCs)-Role of MoP (Ministry of Power)-BEE (Bureau of Energy Efficiency)

UNIT V: ENERGY AUDIT **Hours: 20 Hours**

Definition - Need of Energy audit - Types of energy audit - Energy management (audit) approach - understanding energy costs - Bench marking - Energy performance - Matching energy use to requirements - Maximizing system efficiencies - Optimizing the input energy requirements - Duties and responsibilities of energy auditors - Energy audit instruments - Procedures and Techniques. Introduction to Role of Energy Auditing in Industry Basic elements and measurements - Mass and energy balances - Scope of energy auditing industries - Evaluation of energy conserving opportunities.

Books for study and Reference

1. Energy Management: W.R.Murphy, G.Mckay 109

2. Energy Management Principles: C.B.Smith

3. Efficient Use of Energy : I.G.C.Dryden

4. Energy Economics A.V.Desai

5. Hamies, Energy Auditing and Conservation; Methods Measurements, Management and Case study, Hemisphere, Washington, 1980.