

DEPARTMENT OF RENEWABLE ENERGY SCIENCE

Programme Objectives	M.Sc (Energy Science)	To provide training of post-graduate level in the field of energy, so that the students after successfully completing the programme may take research work in the development of renewable energy system, which are technological and economical viable.
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Programme Specific Outcome	The students after successfully completing the programme may find placements in the Industry with many companies now seeking to exploit the benefits of Green Technology products and processes.
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Course Outcome

S.No	Title of the Subject	Course Outcome
1.	Classical Mechanics	This course helps the student to understand the concepts of mechanics of a system of particles, conservation laws, constraints, generalized coordinates, Lagrange equations, Hamilton's principle, Rigid bodies, Euler's equations, Lorentz transformation, relativistic law .Student will acquire enough knowledge about the mechanics of the macroscopic objects and their laws.
2.	Advanced Electronics	This course helps the student to understand the concepts of forward bias, reverse bias of the diode, LED, OP AMP applications, D/A and A/D conversion, counters: asynchronous, synchronous, transducers with their types. Student will acquire enough knowledge about the basic electronic principles.
3.	Mathematical Physics-I	This course helps the student to understand the concepts of vector calculus, linear algebra, Gamma, Beta, and special functions, probability and statistics, integral transform: Fourier transform, Fourier integral. Student will acquire enough knowledge about the problem solving.
4.	Renewable Energy Resources - I	To understand the different kinds of Energy sources. To study the basis of solar energy and solar radiation measurement. To learn the fundamental principles and theory of wind energy conversion system. Student will acquire enough knowledge about the renewable energy resources.
5.	Physics of Energy	This course helps the student to understand the concepts of energy sources and their technologies. To learn the environmental pollution and climate change. To understand the basic need of carbon free energy. Student will acquire enough

		knowledge about the renewable energy sources.
6.	General electronics experiments	These experiments help in understanding Wien's Bridge oscillator, Astable and monostable Multivibrator using IC555, Phase Shift Oscillator, Characteristics of Photo Diode, Photo Transistor, LDR, LED, 8 bit and 16 bit Addition in 8086 microprocessor, 8 bit and 16 bit Subtraction in 8086 microprocessor, Multiplication in 8086 microprocessor, Division in 8086 microprocessor.
7.	General optics experiments	These experiments help in understanding Michelson Interferometer, Cauchy's constant by curve fitting method, Hartmann's dispersion relation, Elliptic fringes - q , n , σ determination, Hyperbolic fringes - q , n , σ determination, Air wedge, Cleavage step height of crystal by multiple Fizeau fringes, Study of Laser beam parameters (Coherent) Fraunhofer diffraction using Laser, Determination of wavelength of Laser, Haidinger's fringes in a wedge plate, Faraday's rotation using Laser, Fabry - Perot Etalon.
8.	Quantum Mechanics	This course helps the student to understand the concepts of particle duality, uncertainty principle, Angular momentum operators, time independent perturbation theory, WKB approximation, elementary theory of scattering. Student will acquire enough knowledge about microscopic objects and their laws
9.	Mathematical Physics-II	This course helps the student to understand the concepts of complex analysis, group theory, partial differential equations and tensors. Student will acquire enough knowledge about the problem solving skills.
10.	Thermodynamics and Statistical Physics	This course helps the student to understand the concepts of thermodynamical laws and their consequences, quantum statistics of identical particles, Fermi Dirac distribution law, Relation between statistical and thermodynamical quantities. Student will acquire enough knowledge about the thermodynamical and statistical physics.
11.	Solid State Physics	This course helps the student to understand the concepts the classification of condensed matter, Lattice vibrations, Defects and their dislocations, quantum theory of Paramagnetism, diamagnetism, ferromagnetic materials and superconductivity. Student will acquire enough knowledge about vibration defects, dislocations, classification of condensed matter.
12.	Basics Of Renewable Energy Source	To understand the different kinds of Energy sources to study the basis of solar energy, solar radiation measurement and applications of solar energy to learn the fundamental principles and theory of wind energy conversion system. To understand the biogas production from biomass and to study the additional alternate energy sources.
13.	General Energy Experiments	These experiments help in understanding Estimation of Power Configuration of Various Loads, Measurement of power of wind mill Energy Content in Wind. (Prototype Wind Mill of 100W) Determine aerodynamic characteristics of wind turbine

		blades,Energy Audit of residential/institutional building,Efficiency of the fuel cell stack ,Bio-gas,Production from Kitchen waste,Efficiency of electrical motors.
14	General Solar Experiments	These experiments helps in understanding measurement of Intensity of solar radiation ,To study the I-V Characteristics of a solar cell with varying temperature at constant irradiation,To study of the application of solar cell of providing electrical energy to the domestic appliance such as lamp etc.Solar cells in series and parallel- effect of series and shunt resistance.
15	Renewable Energy Sources – II	This course helps the student to understand the concepts of hydropower system, biomass, bio gasification and liquefaction, biogas plants, power generation system using biofuels, ocean thermal energy, wave energy conversion, geothermal energy. Student will acquire enough knowledge about the renewable energy resources.
16	Nuclear Science	This course helps the student to understand the concepts of nuclear forces, nuclear reaction with their types and models, radioactive decay like α -decay, β -decay, nuclear fission, fusion reactors. Student will acquire enough knowledge about the nuclear forces and the nuclear reaction.
17	Spectroscopy	This course helps the students to understand Atomic & Electronic Spectroscopy, Rotational Spectroscopy, Vibrational Spectroscopy, NMR & ESR Spectroscopy. Student will acquire sufficient knowledge about the basics of spectroscopy.
18	Physics Of Materials	This course helps the student to understand the concepts of crystal and amorphous structure in materials about solidification and crystalline imperfections, Thermal and Mechanical properties of solids their phase diagrams and also give introduction about ceramics, glasses their composites. Student will acquire enough knowledge about the structure of materials and their properties.
19	Electromagnetic Theory	This course helps the student to understand the concepts of basic laws in electronic: laplace and Poisson's equations, Electromotive forces: Faraday's law, Maxwell's equations, Potential formulation: Coulomb and Lorentz gauge, Magneto hydrodynamic equations. Student will acquire sufficient knowledge about the basic laws in electrostatics.
20	Solar Energy Conversion Technologies	This course helps the student understand the basic concepts of energy sources, solar energy conversion devices with their operation and maintenance. Solar measuring devices like Multi detectual meter, contactless Thermometer by hands on experience with theoretical aspects.
21	Solid State Physics	This course helps the student understand the basic concepts of Dielectric Constant of liquid, Hysteris Loop, Four Probe Method, Determination of Band gap, Hall effect, Guoy Balance, Quincke's method, Ferroelectric Phase transition, Ultrasonic Interferometer, Ionic conductivity measurement, Etching process: Specimen preparation, Determination of Specific heat of a material.
22	Solar Thermal Energy	This course helps the student to understand the concepts of solar

	Utilization	air heaters, concentrators, solar distillation, solar house, energy storage, Principles of solar cell operation with their types, solar PV module arrays. Student will acquire enough knowledge about the solar thermal utilization.
23	Renewable Energy: Conversion, Storage And Environmental Aspects.	This course helps the student to understand the concepts Renewable energy conversion technologies, electrical storage and their distribution, environmental aspects of energy and pollution control. Student will acquire enough knowledge about renewable energy.
24	Materials Characterization Techniques	This course helps the student understand the basic concepts of structural, thermal, microscopy, Electrical, Spectroscopy Characterization with their principle, Instrumentation and their application .Student will acquire enough knowledge about characterization techniques to determine the structural, thermal, microscopy, Electrical, spectroscopic properties.
25	Hydrogen Production, Storage And Fuel Cells	This course helps the student understand the basic concepts of hydrogen energy from various sources like fossil fuels, biomass, water, and its distribution, storage, Fuel cells with their types. Student will acquire enough knowledge about hydrogen energy sources & understood the basic need of energy sources and it storage with their distribution.
26	Project	The project work is based on synthesis and characterisation of energy materials for various applications such as cathode, anode and electrolyte material for solid oxide fuel cell, grid storage application etc., This will promote the student to initiate themselves in research and the viva – voce examination will ensure their confidence of presenting their work in front of internal and external examiner.

DEPARTMENT OF RENEWABLE ENERGY SCIENCE

<u>Programme Objectives</u>	<u>Title of the programme:</u> P.G. Diploma in Renewable Energy, Management and Auditing	<ol style="list-style-type: none">1) Educating the technologist in the areas of renewable energy resources is the pertinent need of the hour.2) This technology provides unlimited job opportunities for young Indians.3) To learn more about the installation, generation and distribution of power.
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Programme Specific Outcome	1) To have jobs in solar panel production industries & solar panel installation & commission
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Course Outcome:

S.No	Title of the Subject/Course	Course Outcome
1	Energy and Environment	<ol style="list-style-type: none">1) To know about the energy sources and their technologies.2) To learn the environmental pollution and climate change.3) To understand the basic need of carbon free energy.
2	Renewable Energy Sources – I	<ol style="list-style-type: none">1) To understand the different kinds of Energy sources.2) To study the basis of solar energy and solar radiation measurement.3) To learn the fundamental principles and theory of wind energy conversion system.4) Student will acquire enough knowledge about the renewable energy resources
3	Energy Efficiency in Thermal and Electrical systems	<ol style="list-style-type: none">1) This course helps the students to understand the basic concepts of electrical power supply system especially about refrigerators, electric motors, air compressors, fans and lighting systems and their energy saving opportunities.2) And also about the thermal systems such as boilers and furnaces.

4	Energy Auditing and Management	<ol style="list-style-type: none"> 1) This course helps the students to understand the general aspects of energy audit & management with their objectives and their principles of Energy Management. 2) It also helps to know about Procedure and Techniques involved in Auditing. 3) It also provides the aspects of energy policy planning and implementation and also about the energy audit instruments.
5	Practical – I : Electrical and Electronic Principles	<ol style="list-style-type: none"> 1) This course helps the students to impart the practical knowledge of the electrical & Electronics components includes basic logic gates, diode characteristics, operational amplifier, characteristics of LED, Transistor input and transfer characteristics.
6	Renewable Energy Sources – II	<ol style="list-style-type: none"> 1) This course helps the student to understand the concepts of hydropower system, biomass, bio gasification and liquefaction, biogas plants, power generation system using biofuels, ocean thermal energy, wave energy conversion, geothermal energy. 2) Student will acquire enough knowledge about the renewable energy resources.
7	Solar Energy - Conversion Technologies and Utilization	<ol style="list-style-type: none"> 1) This course helps the students to understand the solar energy radiation, conversion Technologies. 2) It also includes Thermal energy conversion, Electrical energy conversion and their utilization in industrial application like grain drying, battery charging, solar pumping.
8	Practical – II : Solar Energy Generation System and Their Utilization– Installing & Servicing	<ol style="list-style-type: none"> 1) This course helps the students to impart the practical knowledge of the Installing & Servicing of solar panel which includes mounting of solar panel , estimation of solar DC pumping system, AC pumping system, sun meter efficiency, efficiency of solar cooker, solar hot water system.
9	Major Project	This helps the students to have an experience in energy management and auditing and help them to understand the theory concepts practically.

DEPARTMENT OF RENEWABLE ENERGY SCIENCE

<u>Programme Objectives :</u>	<u>Title of the programme:</u> M.Phil. Physics (Specialization in Renewable Energy Science)	1) To equip post-graduates with multi-disciplinary skills and knowledge in the areas of solar cells, fuel cells and other energy storage materials etc. 2) To strengthen his/her foundations in research
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Programme Specific Outcome	1) This programme provides the applicants to have a prospective vision to make the country, energy efficient and a good base for the candidate to further proceed in research areas to become teacher and lecturer in schools and colleges. 2) They can also have jobs in many energy sector industries in the country and in abroad as well
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Course Outcome:

S.No	Title of the Subject/Course	Course Outcome
1	Research Methodology	1) Strengthening foundations of research methodology in the subject of Physics 2) To introduce basic mathematical topics necessary to understand and appreciate various physical laws of nature 3) Students will acquire enough mathematical skills to handle variety of equations, appear in various physical situations with ease.
2	Advance Physics	1) Introducing thrust areas of research methodology in the subject of Physics 2) To impart the basic knowledge on nanoscience and technology and various techniques available for the processing and characterization of nanostructured materials, applications in selected fields such as hydrogen storage etc., 3) On successful completion of this course, students would be able to describe important experimental tools in the fields of nano-science
3	Project Oriented Elective Course (Theory) a)Renewable Energy System b) Solar Photovoltaic System c)Energy Storage Materials	a) Renewable Energy System 1) On successful completion of this course the students will have a good knowledge about the various renewable sources and their importance and necessity to our society.

		<p>b) Solar Photovoltaic System</p> <ol style="list-style-type: none"> 2) To introduce the basic physics and technology of photovoltaic science and systems for solar energy harvesting 3) Students will be able to understand the science and technology of solar cells and its design, students can also appreciate various materials properties which are used in photovoltaic devices. <p>c) Energy Storage Materials</p> <ol style="list-style-type: none"> 1) This course helps the student to impart the basic knowledge about fundamentals of nanomaterials and thin films, solar cells and their types and principles, Fuel cell, batteries and super capacitor
4	Project and Viva -voce	<p>The project work is based on synthesis and characterisation of energy materials for various applications such as cathode, anode and electrolyte material for solid oxide fuel cell, grid storage application etc., This will promote the student to initiate themselves in research and the viva – voce examination will ensure their confidence of presenting their work in front of internal and external examiner.</p>