



**ST. ALBERT'S COLLEGE (AUTONOMOUS)**

**ERNAKULAM**

**An initiative of the Archdiocese of Verapoly**

**(Affiliated to Mahatma Gandhi University, Kottayam)**

**DEPARTMENT OF RENEWABLE ENERGY**

**PROGRAMME:**

**B.Voc. RENEWABLE ENERGY**

**Programme Outcomes**

**Programme Specific Outcomes**

**Course Outcomes**

## PROGRAMME OUTCOMES

PO1	<b>Critical Thinking:</b> Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO2	<b>Problem Solving:</b> Solve problems from the Disciplines of concern using the Knowledge, skills and attitude acquired from humanities / science / mathematics / Social Sciences etc.
PO3	<b>Individual and Team Work:</b> An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.
PO4	<b>Environment and Sustainability:</b> Understand the issues of environmental contexts and sustainable development.

## PROGRAMME SPECIFIC OUTCOMES

PSO1	Understand and apply the principles of solid state physics , thermodynamics , nano-science and learn to execute the same in areas of science with the aid of mathematical and computational skills.
PSO2	Demonstrate competence in analysis, design, development and operation of energy systems: bioenergy, heat energy,geothermal energy, wind power ,ocean energy, chemical energy and photovoltaic systems.
PSO3	Attains individual and technical skills including leadership, project management, and communication to work as a professional, or to pursue a career in research
PSO4	To inculcate among the students systematic knowledge and skill about assessing the current energy scenarios and policies ,energy efficiency, energy auditing, energy management and conservation techniques.

**SEMESTER I****RMA1CMT0119: MATHEMATICS-I**

CO	CO Statement	PO/ PSO	Cognitive Level
CO1	Review different types and properties of sets, relations and functions.	PO2/ PSO1	U
CO2	Examine complex numbers, its operations and different forms.	PO2/ PSO1	R
CO3	Correlate limits, continuity and differentiability of functions.	PO2/ PSO3	An
CO4	Represent statistical data diagrammatically and graphically	PO1, PO2/ PSO1	U
CO5	Analyze statistical data using measures of central tendency	PO1, PO2/ PSO4	An

L1: Remembering      L2: Understanding      L4: Analyzing

**CO -PO-PSO Mapping - RMA1CMT0119: MATHEMATICS-I**

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	-	1	-	1	-
CO2	2	2	-	-	1	-	-	-
CO3	2	3	-	1	2	2	2	1
CO4	3	3	1	2	2	2	2	2
CO5	3	3	1	2	3	2	2	2
AVG CO	2.4	2.6	1.33	1.67	1.8	2	1.75	1.67

**REG1CMT0119: FUNDAMENTALS OF COMPUTER**

<b>CO No.</b>	<b>Course Outcomes</b>	<b>PSOs</b>	<b>Cognitive Level</b>
CO-1	Explain the basics of computer hardware and software	PO1/PO2/PO3/PO4/ PSO1	U
CO-2	Recalling the fundamental concepts of computers	PO1/PO2/PO3/ PSO1/PSO3	R
CO-3	Illustrate and describe the basic tasks or operations in MS Word	PO1/PO2PO3/PO4/ PSO1/PSO2/PSO3/P SO4	An
CO-4	Illustrate and describe basic tasks or operations in MS Excel	PO1/PO2PO3/PO4/ PSO1/PSO2/PSO3/ PSO4	An
CO-5	Illustrate and describe the basic tasks in MS PowerPoint	PO1/PO2PO3/PO4/ PSO1/PSO2/PSO3/P SO4	An

L1: Remembering

L2: Understanding

L3: Analyzing

**CO -PO-PSO MAPPING - FUNDAMENTALS OF COMPUTER**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
<b>CO1</b>	2	1	2	2	2	-	-	-
<b>CO2</b>	2	1	2	-	2	-	1	-
<b>CO3</b>	2	3	2	1	2	2	1	2
<b>CO4</b>	2	3	1	2	2	2	2	2
<b>CO5</b>	2	3	1	2	2	2	2	2
<b>AVG CO</b>	2	2.2	1.6	1.75	2	2	1.75	2

**RPH1CRT0119-PHYSICS-I: UNITS AND MEASUREMENTS, CIRCUIT THEORY AND ELECTRICAL FUNDAMENTALS**

CO	CO Statement	PO/ PSO	CL
CO1	Illustrate atomic structure and classify solids based on energy bands.	PO1,PO2 / PSO1	U
CO2	Associate the concept of semiconductors with real world applications	PO1,PO2,PO3 / PSO2	U
CO3	Analyze the working of basic electronic circuits and devices	PO1,PO2,PO3 PO4 / PSO2	An
CO4	Apply semiconductor principles in optoelectronic devices	PO1,PO2,PO3, PO4/ PSO2	A
CO5	Analyze the properties of various components of electric circuit	PO1,PO2,PO3 PO4 / PSO2	An

**CO -PO-PSO Mapping – RPH1CRT0119 - PHYSICS-I: UNITS AND MEASUREMENTS, CIRCUIT THEORY AND ELECTRICAL FUNDAMENTALS**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	1	-	-	2	-	-	-
CO2	2	3	2	-	-	2	-	-
CO3	1	3	2	2	-	2	-	-
CO4	2	2	1	3	-	2	-	-
CO5	1	3	2	2	-	2	-	-
<b>AVG CO</b>	<b>1.6</b>	<b>2.4</b>	<b>1.75</b>	<b>2.33</b>	<b>2</b>	<b>2</b>	<b>-</b>	

**REG1CRT0119: RENEWABLE ENERGY I- FUNDAMENTALS OF SUSTAINABLE ENERGY & DEVELOPMENT**

CO	CO Statement	PO/ PSO	CL
CO 1	Summarize about the need of different renewable energy resources and to relate about the historical and latest developments.	PO1/PO2/PO4/ PSO1//PSO2	U
CO 2	Analyze about the potential of solar energy and to discuss about the harvesting of solar energy	PO1/PO2/PO4/ PSO1//PSO2	An
CO 3	Illustrate the various applications of solar energy	PO1/PO2/PO4/ PSO1//PSO2	U
CO 4	Illustrate about the usable forms of biomass ,biomass conversion technologies and biogas plants,	PO1/PO2/PO3/ PO4/PSO1/ PSO2/PSO4	A
CO5	Associate about basic principles of wind energy conversion and various forms of sustainable energy resources.	PO1/PO2 PO3/PO4/ PSO2/ PSO4	U

**CO -PO-PSO Mapping: REG1CRT0119: RENEWABLE ENERGY I: FUNDAMENTALS OF SUSTAINABLE ENERGY & DEVELOPMENT**

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	-	3	1	2	-	-
CO2	2	3	-	2	2	3	-	-
CO3	2	2	-	3	2	2	-	-
CO4	2	1	2	3	1	3	-	2
CO5	2	1	1	3	-	3	-	1
AVG CO	2	1.8	1.5	2.8	1.5	2.6	-	1.5

**REG1CRP0119- GENERAL PHYSICS LAB**

CO	CO Statement	PO/ PSO	CL
CO1	Develop practical knowledge by applying the experimental methods to associate with the Physics theory.	PO1,PO3 / PSO1,PSO2	A
CO2	Analyze the role of direct observation in physics and also the coherence between theory and practical experiments.	PO1,PO2,PO3 / PSO1,PSO2, PSO3	An
CO3	Understand advanced measurement technology, usage of new instruments.	PO1,PO3,PO4 / PSO3	U
CO4	Analyse the basic circuit diagrams and construct the electric circuit for taking measurements	PO1,PO2,PO3 / PSO1,PSO2 ,PSO3	An
CO5	Develop scientific measurement skill and analysis and verification of observational data	PO1,PO3 / PSO1,PSO2	U

**CO -PO-PSO Mapping -:REG1CRP0119- GENERAL PHYSICS LAB**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	-	2	-	2	2	-	-
CO2	2	2	2	-	2	1	1	-
CO3	2	-	2	2	-	-	2	-
CO4	2	2	2		2	2	2	
CO5	2		2		2	2		
AVG CO	2	2	2	2	2	1.75	1.66	-

**REG1CRP0219: COMPUTER APPLICATION LAB - MATLAB**

CO	CO Statement	PO/ PSO	CL
CO1	Understand the main features of MATLAB program and enable to use in higher learning	PO1,PO2,PO3 /PO4/PSO1/PSO2/ PSO3/PSO4	U
CO2	Interpret and visualize simple mathematical functions and operations there on graphing them using plots/display.	PO1,PO2,PO3 /PO4/PSO1/PSO2/ PSO3/PSO4	A
CO3	Apply a variety of common numeric techniques to solve and visualize engineering-related computational problems.	PO1,PO2,PO3 /PO4/PSO1/PSO2/ PSO3/PSO4	A
CO4	Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using MATLAB tools.	PO1,PO2,PO3 /PO4/PSO1/PSO2 /PSO3/PSO4	An
CO5	Demonstrate the application of loop control statements in MATLAB program	PO1,PO2,PO3 / PO4/PSO1/PSO2/ PSO3/PSO4	A

**CO -PO-PSO MAPPING - COURSE NAME: REG1CRP0219: COMPUTER APPLICATION LAB - MATLAB**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	1	3	3	2	2	2	2	1
CO2	2	3	2	1	2	2	2	1
CO3	2	2	2	1	1	2	2	1
CO4	2	2	3	2	1	2	2	1
CO5	1	2	2	2	2	1	2	1
AVG CO	1.6	2.4	2.4	1.6	1.6	1.8	2	1



**SEMESTER II****RMA2CMT0119: MATHEMATICS-II**

CO	CO Statement	PO/ PSO	CL
CO1	Determine the extreme values of functions using derivative tests	PO2/ PSO2	A
CO2	Define functions having more than one variable.	PO2/ PSO1	R
CO3	Determine partial derivatives of functions of several variable	PO2/ PSO1	A
CO4	Determine rank and inverse of a matrix using elementary row transformations	PO2/ PSO1	A
CO5	Apply different numerical methods to obtain approximate solutions to mathematical problems	PO1/ PSO1	A

L1: Remembering    L3: Applying

**CO -PO-PSO Mapping - RMA2CMT0119: MATHEMATICS-II**

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	1	3	2	1	1
CO2	2	2	-	-	2	-	-	1
CO3	2	2	-	-	2	1	-	1
CO4	2	3	1	2	2	-	2	1
CO5	3	3	-	2	3	1	1	2
AVG CO	2.2	2.6	1.5	1.67	2.4	1.33	1.33	1.2

**NORPH2CMT0119: PHYSICS-II BASIC ELECTRONICS**

CO No.	Course Outcomes	PSOs	Cognitive Level
CO-1	Recall the basics of electronics	PO1,PO2,PO3, PO4,PSO1,PSO2, PSO3,PSO4	R
CO-2	Discuss the fundamentals of semiconductors	PO1,PO2,PO3, PSO1,PSO2, PSO3,PSO4	U
CO-3	Illustrate the basics of semiconductor diode and transistors	PO1,PO2,PO3,PO4/ PSO1,PSO2, PSO3,PSO4	U
CO-4	Discuss the fundamentals of Opto-electronic devices	PO1,PO2,PO3,PO4/ PSO1,PSO2, PSO3,PSO4	U
CO-5	Understand the ways of classification of photodetectors and its efficiency parameters	PO1,PO4, PSO1,PSO2	U

**CO -PO-PSO Mapping - PHYSICS-II: BASIC ELECTRONICS**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	3	2	2	2	2	2	2
CO2	2	1	1	-	2	1	1	1
CO3	1	2	2	1	2	1	2	1
CO4	2	1	1	2	1	1	1	1
CO5	1	-	-	3	2	2	-	-
AVG CO	1.6	1.4	1.2	1.6	1.8	1.4	1.2	1

**REG2CRT0119-RENEWABLE ENERGY-II: PHYSICO-CHEMICAL PROCESSES FOR WATER AND WASTEWATER TREATMENT**

CO	CO Statement	PO/ PSO	CL
CO1	Explain how and why the physical, chemical and biological parameters of water vary	PO1, PO4 / PSO2	U
CO2	Organize the types of sedimentation and disinfection	PO1, PO2, PO3, PO4 / PSO3	An
CO3	Classify the filtration techniques	PO1, PO3, PO4 / PSO3	An
CO4	Design various methods for water treatment process	PO1, PO2, PO3, PO4 / PSO3, PSO4	C
CO5	Significance of wastewater treatment and filtration methods	PO1, PO3/PSO4	An

**CO -PO-PSO Mapping - REG2CRT0119- RENEWABLE ENERGY-II: PHYSICO-CHEMICAL PROCESSES FOR WATER AND WASTEWATER TREATMENT**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	-	-	1	-	2	-	-
CO2	2	2	2	1	-	-	2	-
CO3	2	-	1	2	-	-	2	-
CO4	2	1	2	2	-	-	2	2
CO5	3	-	2	-	3	-	-	-
<b>AVG CO</b>	<b>2.2</b>	<b>1.5</b>	<b>1.75</b>	<b>1.5</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>

### REG2CRT0219 RENEWABLE ENERGY-III: PHOTOVOLTAIC MODULE INSTALLATION

CO	CO Statement	PO/PSO	CL
CO1	To identify various types of solar cells and PV modules and also the various parameters relating to it.	PO1/PSO1, PSO4, PO2	U
CO2	To analyse and compare about different types of inverters and to examine various connection systems.	PO1,PO2, PO3, PO4/ PSO1,PSO2	An
CO3	To estimate the need for site surveys and to focus on the effect of shading analysis on PV modules.	PO1,PO3,PO4, PSO3,PO2	An
CO4	Illustrate the concepts of planning and sizing of grid connected photovoltaic systems.	PO1,PO2/ PSO2,PSO3	U
CO5	Familiarize the sizing and selection of cables, PV modules, AC/DC switches etc	PO1,PO2,PO4,PSO1	U

### CO -PO-PSO Mapping - REG2CRT0219 RENEWABLE ENERGY-III: PHOTOVOLTAIC MODULE INSTALLATION

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	1	-	-	2	-	-	2
CO2	2	2	1	1	2	2	-	-
CO3	3	2	3	2	-	-	3	-
CO4	2	2	-	-	-	2	2	-
CO5	1	2	-	-	3	1	-	-
AVG CO	2	4.5	2	1.5	2.33	1.67	2.5	2

## REG2CRP0119 PRACTICAL- ELECTRONICS & PHOTOVOLTAIC MODULE INSTALLATION

CO	CO STATEMENT	PO/PSO	CL
CO 1	Perform experiments to plot the V-I characteristics of electronic components	PO1/ PSO3/PO4/ PSO1	U
CO 2	Apply the electronic principles to calculate the efficiency and regulation of rectifiers.	PO2,PO3/ PSO2,PSO1, PSO3,PSO4	A
CO 3	Familiarize with appropriate access equipment and basic roofing techniques for PV module installation	PO2/ PO4,PSO2/ PSO1,PSO3	U
CO4	Carry out measurement within PV modules and array	PO2/ PSO1,PSO2, PSO3,PSO4	A
CO5	Fault diagnosis on modules array	PO1,PO3/ PSO1,PSO3	A

### CO -PO-PSO Mapping - COURSE NAME: REG2CRP0119 PRACTICAL- ELECTRONICS & PHOTOVOLTAIC MODULE INSTALLATION

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	-	-	1	3	-	1	-
CO2	-	2	2	-	2	3	3	2
CO3	-	3	-	2	2	3	3	-
CO4	-	3	-	-	3	2	3	3
CO5	1	-	2	-	3	-	2	-
AVG CO	1.5	2.7	2	1.5	2.6	2.6	2.4	1

**SEMESTER III**

<b>Course code</b>	<b>Course title</b>	<b>Credits</b>	<b>Total Hrs</b>	<b>Hrs/ Wk</b>	<b>Internal</b>	<b>External</b>
RCH3CMT 0119	Chemistry-II: Physical Chemistry	4	60	3	20	80
RPH3CMT 0119	Physics-III : Thermodynamics and Fluid Mechanics	4	60	3	20	80
REG3CMT 0119	Renewable Energy-IV : Novel Energy Resources	4	60	3	20	80
REG3CRT 0119	Renewable Energy-V : Solar Thermal Technology-I	5	75	4	20	80
REG3CRT 0219	Renewable Energy-VI : Wind Energy	5	75	4	20	80
REG3CRP 0119	Practical- Thermodynamics & Solar Thermal	4	60	4	20	80
REG3CRP 0219	Practical- Fluid dynamics & Wind Energy	4	60	4	20	80

**RCH3CMT0119-CHEMISTRY-II: PHYSICAL CHEMISTRY**

CO	CO Statement	PO/ PSO	CL
CO1	Interpret the chemical reaction rates	PO1,PO2/ PSO1	U
CO2	Explain crystal systems, bonding in crystals and magnetic properties of solids	PO1,PO2,PO3 /PSO1	U
CO3	Develop theoretical basis for photochemistry to handle photochemical instrumentations	PO1,PO2,PO3,P O4 / PSO2	A
CO4	Discuss the basics of nuclear chemistry applications: nuclear power and carbon dating.	PO1,PO2,PO3,P O4 / PSO2	U
CO5	Discuss the working of nuclear reactor and disposal of nuclear waste	PO1, PO2/ PSO1, PSO4	U

**CO – PO - PSO Mapping - RCH3CMT0119- CHEMISTRY-II: PHYSICAL CHEMISTRY**

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	-	2	-	-	-
CO2	2	2	1	-	3	-	-	-
CO3	1	1	2	2	-	2	-	-
CO4	2	3	1	3	-	-	2	-
CO5	2	1	-	-	2	-	-	2
AVG CO	1.8	2	1.33	2.5	2.33	2	2	2

### RPH3CMT0119-PHYSICS-III: THERMODYNAMICS & FLUID MECHANICS

CO	CO Statement	PO/ PSO	CL	Levels of taxonomy
CO1	Interpret the laws of thermodynamics	PO1,PO2 / PSO1	U	L2
CO2	Apply the fundamentals of the three heat transfer modes in hands on experiments	PO1,PO2,PO3, PO4 / PSO1, PSO2	A	L3
CO3	Identify the properties of fluids and fundamentals of fluid mechanics	PO1,PO2,PO3 / PSO1, PSO3	U	L3
CO4	Evaluate the performance characteristic of fluid flow through pipes and orifice	PO1,PO2,PO3, PO4 / PSO3, PSO4	An	L4
CO5	Understand Bernoullis equation and its application	P01/ PSO1, PSO2		

### CO -PO-PSO Mapping RPH3CMT0119-PHYSICS-III : THERMODYNAMICS & FLUID MECHANICS

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	-	-	3	-	-	-
CO2	2	3	3	1	2	2	-	-
CO3	2	3	2	-	2	-	1	-
CO4	2	1	2	3	-	-	2	2
C05	2	-	-	-	2	1	-	-
AVG CO	2	2.25	2.33	2	2.25	1.5	1.5	2



### REG3CRT0119: RENEWABLE ENERGY-IV NOVEL ENERGY RESOURCES

CO	CO Statement	PO/ PSO	CL
CO1	Explain the field applications of hydrogen energy	PO-1/PSO-2	U
CO2	Identify the need of energy conversion and the various methods of energy storage	PO-4/PSO-4	R
CO3	Explain Geothermal & Ocean energy, its mechanism of production and its applications	PO-4/PSO-2	A
CO4	Illustrate the concepts of Direct Energy Conversion systems & their applications	PO-1/PSO-4	An
C05	Understand magnetic and electric storage system	PO1/ PSO1	U

### CO -PO-PSO Mapping - REG3CRT0119 RENEWABLE ENERGY-IV: NOVEL ENERGY RESOURCES

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	1	-	1	2	2	-	1
CO2	1	1	2	3	1	1	-	3
CO3	1	1	1	3	-	2	3	1
CO4	2	2	2	1	-	1	1	3
C05	2	-	-	-	1	-	-	-
AVG CO	1.6	1.25	1.6	2	1.33	1.5	2	2

**REG3CRT0219 RENEWABLE ENERGY-V: SOLAR THERMAL TECHNOLOGY-I**

CO	CO Statement	PO/ PSO	CL
CO1	Explain the principles that underlie the ability of various natural phenomena to deliver solar energy.	PO-1, PO2/PSO1, PSO2, PS03, PSO4	U
CO2	Evaluate and analyze the performance of solar collectors.	PO1, PO2, PO3, PO4/PSO1,PSO2,P SO3, PSO4	An
CO3	Analyze the working of various solar concentrators.	PO1, PO2, PO3, PO4/PSO1,PSO2,P SO3, PSO4	An
CO4	Discuss the potential applications of solar thermal energy.	PO1, PO2, PO3, PO4/PSO1,PSO2,P SO3, PSO4	U
CO5	Understand solar cooling of building and solar thermal energy	PO1, PO2/ PSO1, PSO2	U

**CO -PO-PSO Mapping - REG3CRT0219 RENEWABLE ENERGY-V: SOLAR THERMAL TECHNOLOGY-I**

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO-4
CO1	2	1	-	-	2	2	1	1
CO2	1	2	2	3	1	2	3	2
CO3	1	2	2	3	2	2	3	2
CO4	2	3	1	3	1	2	3	2
CO5	2	2	-	-	2	1	-	-
AVG CO	1.6	2	1.66	3	1.6	1.8	2.5	1.75

**REG3CRT0220: RENEWABLE ENERGY-VI: WIND ENERGY**

CO No.	Course Outcomes	PO/PSOs	CL
CO1	Evaluate different wind energy policy environments and analyze and critique the relative merits of alternative policy scenarios	PO4/PSO4	An
CO2	Analyze key wind farm planning studies and explain the implications of the studies for wind farm development	PO3, PO4 / PSO1	An
CO3	Understand the wind energy systems and design tradeoffs for the large components	PO1, PO2, PO3, PO4/PSO1, PSO3, PSO4	U
CO4	Identify problems and potential solutions associated with integrating high wind penetrations into the electric grid	PO1,PO2, PO4/PSO1, PSO2, PSO4	R
CO5	Understand the factors influencing wind energy economics and site specific parameters	PO1/PSO1	R

**CO -PO-PSO Mapping - REG3CRT0219: RENEWABLE ENERGY-VI: WIND ENERGY**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1				3				3
CO2			2	3	3			
CO3	2	2	2	2	2	1	2	2
CO4	2	3		3	2			2
CO5	2	-	-	-	1	-	-	-
AVG CO	2	2.5	2	2.75	1.8	1	1.5	2.25

**REG3CRP0119: THERMODYNAMICS AND SOLAR THERMAL**

CO	CO Statement	PO/ PSO	CL
CO1	Experimental investigations of solar thermal systems and understand the implications of the results.	PO-3/ PSO-2	An
CO2	Estimate the system efficiency and heat loss of a flat plate collector.	PO-3/ PSO-2	E
CO3	To study the effect of change in parameters such as wind speed, irradiation and ambient temperature	PO-3/ PSO-2	An
CO 4	To understand and compare the pressure in various tubes with design values	PO-3/ PSO-2	E
CO 5	Understand the behaviour of flat plate collector with variation in radiation level and water temperature	PO3/ PSO2	E

**CO -PO-PSO Mapping - REG3CRP0119 THERMODYNAMICS AND SOLAR THERMAL**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	1	1	2	1	1	3	3	3
CO2	1	1	2	1	1	3	3	3
CO3	2	2	1	2	2	1	2	1
CO4	1	1	1	3	2	1	1	1
C05	-	-	2	-	-	2	-	-
AVG CO	1.25	1.25	1.6	1.75	1.25	2	2.25	2

### REG3CRP0219 PRACTICAL- FLUID DYNAMICS AND WIND ENERGY

CO	CO Statement	PO/ PSO	CL
CO1	Develop practical knowledge by applying the experimental methods to associate with fluid dynamics and wind energy.	PO1/ PSO2	A
CO2	Evaluate the role of direct observation in wind turbines and also the comparison between theory and practical experiments.	PO1/ PSO2	An
CO3	Analyze the advanced measurement of wind energy with the aid of new instruments.	PO1/ PSO4	An
CO4	Analyze the power output and its quality of wind energy systems	PO1/ PSO3	An
CO5	Analyze the effect of load on power output and its quality	PO1, PO3/PSO2	An

#### CO -PO-PSO Mapping - COURSE NAME REG3CRP0219 PRACTICAL- FLUID DYNAMICS AND WIND ENERGY

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	2	2	2	2	3	1	2
CO2	2	2	2	2	2	3	1	2
CO3	2	2	2	2	2	2	1	3
CO4	2	2	2	2	2	2	3	2
CO5	2	-	1	-	-	2	-	-
AVG CO	2	2	1.8	2	2	2.4	1.5	2.25

**SEMESTER IV****REG4CRT0119 RENEWABLE ENERGY-VII: SOLAR THERMAL TECHNOLOGY-II**

CO	CO Statement	PO/ PSO	CL
CO1	Apply principles of heat and mass transfer to predict transfer coefficients.	PO-1/ PSO-1/ PSO-2/PSO-3/ PSO-4	A
CO2	Analyzing and testing various flat plate collectors	PO-1/PO-2/PO-3/ PO-4/ PSO-1/ PSO-2/PSO-3/PSO-4	An
CO3	Evaluating the performance of evacuated tubular collectors	PO-1/PO-2/PO-3/ PO-4/ PSO-1/ PSO-2/PSO-3/PSO-4	An
CO4	Thermal analysis of solar systems	PO-1/PO-2/ PO-4/ PSO-1/PSO-2 /PSO-3/PSO-4	An
CO5	Analyzing the economic aspects of solar system	PO-1/PO-2/PO-4/ PSO-1/PSO-2/ PSO-3/PSO-4	An

**CO -PO-PSO Mapping - REG4CRT0119 RENEWABLE ENERGY-VII: SOLAR THERMAL TECHNOLOGY-II**

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	2	2	1	1
CO2	2	2	3	2	1	2	3	2
CO3	2	2	3	2	2	2	1	2
CO4	2	1	-	2	1	1	2	2
CO5	2	3	-	2	2	2	2	2
AVG CO	2	2	3	2	1.6	1.8	1.8	1.8

**REG4CMT0119- MATERIAL SCIENCE**

CO	CO Statement	PO/ PSO	CL
CO1	Describe the fundamentals of nanoscience and discuss the various properties and synthesis of nanoparticles.	PO-1/PO-2/PO-3/ PO-4/ PSO-1/ PSO-3/PSO-4	U
CO2	Describe the synthesis of nanoparticles and characterization methods	PO-1/PO-2/PO-3/ PO-4/ PSO-1/ PSO-3/PSO-4	U
CO3	Explain the actual working areas and applications of nanotechnology	PO-1/PO-2/PO-3/ PO-4/ PSO-1/ PSO-2/PSO-3/PSO-4	A
CO4	Discuss on the various classification of polymers.	PO-1/PO-2//PO-4/ PSO-1/	U
CO5	Describe thin film technology and differentiate physical and chemical methods of thin film fabrication.	PO-1/PO-2/PO-4/ PSO-1/PSO-2/ PSO-3/PSO-4	U

**CO -PO-PSO Mapping-REG4CMT0119: MATERIAL SCIENCE**

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO-4
CO1	2	1	1	2	2	-	1	1
CO2	2	2	1	2	2	-	2	1
CO3	2	2	2	2	2	2	2	2
CO4	2	2	-	1	2	-	-	
CO5	2	1	-	1	2	1	1	2
AVG CO	2	1.6	1.33	1.6	2	1.5	1.5	1.5

**REG4CMT0219 ENVIRONMENTAL EDUCATION**

CO	CO Statement	PO/ PSO	CL
CO1	To assess necessary scientific concepts while encountering environmental problems	PO-1/PO-2/PO-4/ PSO-1/ PSO-2/PSO-4	U
CO2	To prepare for employment and graduate studies in the analysis and mitigation of environmental problems	PO-1/PO-2/ PO-3/PO-4/ PSO-1/ PSO-2/ PSO-4	U
CO3	Analyse the national and international level environment protection measures and environment management	PO-1/PO-2/ PO-3/ PO-4/ PSO-1/ PSO-2/ PSO-3/PSO-4	A
CO4	To appreciate the ethical, cross cultural and historical context of environmental issue and the links between human and natural systems	PO-1/PO-2/ PO-3/PO-4/ PSO-2/ PSO-3/PSO-4	U
CO5	To understand the environmental problems and ways to minimize them	PO-1/PO-2/ PO-3/PO-4/ PSO-2 /PSO-3/PSO-4	U

**CO -PO-PSO Mapping - COURSE NAME: REG4CMT0219  
ENVIRONMENTAL EDUCATION**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	1	-	1	2	2	-	1
CO2	1	1	2	3	1	1	-	3
CO3	2	1	1	3	2	1	1	2
CO4	1	1	1	3	-	2	3	1
CO5	2	2	2	1	-	1	1	3
<b>AVG CO</b>	<b>1.6</b>	<b>1.2</b>	<b>1.5</b>	<b>2.2</b>	<b>1.66</b>	<b>1.4</b>	<b>1.66</b>	<b>2</b>



**REG4CRT0119 RENEWABLE ENERGY-VIII: SOLAR PHOTOVOLTAIC ENERGY CONVERSION-I**

CO	Co Statement	PO/PSO	CL
CO 1	Cite about the working of solar cell, various parameters and methods to maximise its performance.	PO-1/PO-2/PSO-1/PSO-2/PSO-4	U
CO 2	Analyse about different solar PV modules, its design and different type of connections.	PO-1/PO-2/ PSO-1/PSO-2/PSO-3	An
CO 3	Analyse the quality of a solar module and identification of optimum location for installation	PO-1/PO-2/PO-3/PO-4/ PSO-1/PSO-2/PSO-3/PSO-4	An
CO 4	Identification and the use of tools and equipment for solar PV installation	PO-1/PO-2/PO-3/ PSO-1/PSO-2/ PSO-3	U
CO 5	Review the overall system inspection	PO-1/PO-2/ PO-3/PSO-1/ PSO-2/PSO-3/ PSO-4	An

**CO -PO-PSO Mapping: REG4CRT0119 RENEWABLE ENERGY-VIII: SOLAR PHOTOVOLTAIC ENERGY CONVERSION-I**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	3	-	-	1	3	-	2
CO2	1	3	-	-	2	3	1	-
CO3	3	1	1	2	1	2	2	2
CO4	1	2	1	2	-	3	2	-
CO5	1	2	2	1	-	3	2	1
AVG CO	1.6	2.2	1.33	1.67	1.33	2.8	1.75	1.67

### REG4CRT0220: RENEWABLE ENERGY-IX: ENERGY STORAGE SYSTEMS

CO No.	Course Outcomes	PO/PSO	CL
CO-1	Apply engineering fundamentals to design and implement electrical energy storage technologies such as hydrogen based systems and batteries to support sustainable energy solutions	PO-1/PO-2/PO-3/ PO-4/ PSO-1/ PSO-2/PSO-3/PSO-4	A
CO-2	Evaluate electrical energy storage systems when used in conjunction with sustainable energy solutions	PO-1/PO-2/PO-3/ PO-4/ PSO-1/ PSO-2/PSO-3/PSO-4	A
CO-3	Discuss the scientific principles underpinning the operations of energy storage systems	PO-1/PO-2/PO-3/ PO-4/ PSO-1/ PSO-2/PSO-3/PSO-4	A
CO-4	Develop problem solving skills in energy storage engineering as a means of resolving intermittency of renewable energy sources such as solar and wind	PO-1/PO-2/PO-3/ PO-4/ PSO-1/ PSO-2/PSO-3/PSO-4	An
CO-5	Analyse latent heat and thermal energy storage systems	PO-4/ PSO-1/ PSO-2//PSO-4	An

### CO -PO-PSO Mapping-REG4CRT0219: RENEWABLE ENERGY-IX: ENERGY STORAGE SYSTEMS

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	1	3	2	2	3	2	2
CO2	1	2	3	2	2	2	3	2
CO3	3	2	2	3	1	1	3	2
CO4	2	3	3	2	3	2	2	2
CO5	-	-	-	2	2	2	-	2
AVG CO	2	2	2.75	2.2	2	2	2.5	2

### REG4CRP0119 PRACTICAL- SOLAR PHOTOVOLTAIC & ENERGY STORAGE SYSTEMS

CO	CO Statement	PO/ PSO	CL
CO1	Practice PV systems electrical and mechanical design/integration and examine the system performance.	PO1,PO3,PO4 / PSO2,PSO4	A
CO2	Analyze the operation of relevant energy storage systems and usage of tools in the system evaluation.	PO1,PO2,PO3,PO4/ PSO2,PSO4	An
CO3	Understand advanced measurement technology, usage of new instruments.	PO1,PO3,PO4 / PSO3,PSO4	U
CO4	Analysis of the working of PV system under various physical conditions	PO1/PO2/PO3/PSO1/ PSO2/PSO3/PSO4	
CO5	Develop the skills for experimental design, analysis and numerical calculations of PV system	PO1/PO2/PO3/PO4/ PSO1/PSO2/PSO3/ PSO4	

### CO -PO-PSO Mapping - REG4CRP0119 PRACTICAL- SOLAR PHOTOVOLTAIC & ENERGY STORAGE SYSTEMS

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	-	2	1	-	3	-	1
CO2	2	2	2	1	-	1	-	2
CO3	2	-	2	2	-	-	2	2
CO4	2	3	2	-	1	2	2	1
CO5	1	2	1	2	1	3	1	2
AVG CO	1.8	1.4	1.8	1.5	1	2.25	1.67	1.6

**SEMESTER V**  
**REG1CMT0120: LASER AND OPTICAL INSTRUMENTS**

CO No.	Course Outcomes	PO/PSOs	Cognitive Level
CO-1	Describe the requirements for a system to act as a laser	PO1, PO3, PO4/PSO1, PSO3, PSO4	U
CO-2	Relate the structure and properties of lasers to this performance and intended applications	PO1, PO3, /PSO2	U
CO-3	Assess which laser would best meet the need for a particular industrial/ research task	PO1, PO2/PSO1, PSO4	E
CO-4	Develop an awareness of the safety responsibilities involved in working with lasers	PO1,PO2, PO3, PO4/PSO2 PSO3	U
CO5	Analyse various fabrication techniques of optical glasses	PO2/PO4/PSO1/PSO2 /PSO4	An

**CO -PO-PSO MAPPING - REG1CMT0120: LASER AND OPTICAL INSTRUMENTS**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	-	2	2	2	-	2	1
CO2	2	-	2	-	-	2	-	-
CO3	3	3	-	1	2	-	-	2
CO4	2	2	2	2	-	2	3	1
CO5	-	2	-	2	3	2	-	2
AVG CO	2.25	2.6	2.0	1.75	2.3	2.0	2.5	1.5

**REG5CMT0119: RENEWABLE ENERGY-X- ENVIRONMENT,  
HEALTH & SAFETY IN INDUSTRIES**

CO	CO Statement	PO/ PSO	CL
CO1	To study and implement practical aspects of environmental protection and safety at work	PO-1/ PO2/ PO4/ PSO1/PSO2PSO-4	U
CO2	To make sure that their activities do not cause any harm to anyone	PO1/PO2/PO3/ PO4/PSO-1/ PSO2/PSO3/PSO4	R
CO3	To understand the different types of safety problems and their sustainable solutions	PO1/PO2/PO3/ PO-4/PSO-2/ PSO3/PSO4	A
CO4	Illustrate the health & safety concepts and objectives for the H&S work and how to behave safely during field work	PO1/PO2/PO3/ PO-4/PSO-2/ PS O3/PSO4	An
CO5	To understand the principles and methods of effective Training programmes	PO1/PO-3/PSO-3	U

**CO -PO-PSO Mapping - Course Name: Reg5cmt0119 Renewable Energy-X:**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	1	-	1	3	2	-	1
CO2	1	1	2	3	3	1	3	3
CO3	1	1	1	3	-	2	3	1
CO4	2	2	2	1	-	1	1	3
CO5	3		3		-	-	2	-
AVG CO	1.8	1.25	2.0	2	3.0	2.0	2.25	2.0

**Environment, Health & Safety In Industries****REG5CMT0219: RENEWABLE ENERGY-XI: PROJECT MANAGEMENT**

CO No.	Course Outcomes	PSOs	Cognitive Level
CO-1	Explain the basics of project Management and its scope	PO-1/PO2/PO3/PO4/ PSO2PSO-4	U
CO-2	Describe and develop skills about project implementation and monitoring	PO-1/PO2PO3/PO4/ PSO1/PSO2PSO-4	An
CO-3	Describe about project team management, rules and organizations	PO-1/PO2PO3/PO4/ PSO1/PSO2PSO-4	U
CO-4	Discuss the termination of and inventory management of project	PO-1/PO2PO3/PO4/ PSO1/PSO2PSO-4	U
CO-5	Explaining Practical and Legal aspects of Project Team Management	PO1/PO2/PSO3	U

L2: Understanding

L3: Analyzing

**CO -PO-PSO Mapping - COURSE NAME: RENEWABLE ENERGY-XI: PROJECT MANAGEMENT**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	2	2	2	-	1	2	1
CO2	2	2	2	1	1	2	3	1
CO3	3	1	2	1	1	1	2	2
CO4	2	1	1	1	2	1	3	2
CO5	2	2	-	-	-	-	2	-
AVG CO	2.75	1.6	1.75	1.25	1.3	1.25	2.4	1.5

**REG5CRT0120 XII: ENERGY CONSERVATION TECHNIQUES**

CO No.	Course Outcomes	PO/PSOs	Cognitive Level
CO-1	List several ways to conserve energy	PO-1/PO2/PO3/ PO4/PSO1/PSO2/ PSO3/PSO-4	R
CO-2	Explain that energy in its various form that affect every day objects and involved in everyday events	PO-1/PO2/PO3 /PO4/PSO1/PSO2/ PSO3/PSO-4	U
CO-3	Describe remedies/potential solutions to the supply environmental issues associated with fossil fuels and other energy resources	PO-1/PO2/PO3/ PO4/PSO1/PSO2/ PSO3/PSO-4	U
CO-4	Examine strategic and policy recommendations on energy conservation and energy auditing	PO-1/PO2/PO3/ PO4/PSO1/PSO2/ PSO3/PSO-4	A
CO 5	Familiarize Energy Efficient Building Techniques	PO1,PO2,PO3, PO4/PSO4	A

**CO -PO-PSO Mapping - REG5CRT0120-ENERGY CONSERVATION TECHNIQUES**

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	3	3	2	3	2
CO2	2	2	3	2	2	2	3	2
CO3	3	3	1	3	3	2	2	2
CO4	2	2	2	2	2	2	2	3
CO5	2	2	2	2	-	-	-	2
AVG CO	2.2	2.0	2.0	2.4	2.5	2.0	2.5	2.2

### REG5CRT0219 RENEWABLE ENERGY-XIII SOLAR PHOTOVOLTAIC ENERGY CONVERSION-II

CO	CO Statement	PO/PSO	Cognitive Level
CO 1	Identify various parameters and design of solar cells	PO1,PO2,PO3,PO4/ PSO1/PSO2/PSO4	U
CO 2	Analyse different types of solar cells based on the method of fabrication	PO1,PO2,PO4/PSO2 /PSO3	A
CO 3	Discuss about various processes in the purification of silicon	PO1,PO2,PO4/PSO1 /PSO2	U
CO 4	Differentiate between types of Solar PV systems and calculation of Life cycle costing of a PV system	PO1,PO2,PO3,PO4/ PSO2/PSO3	U
CO5	Discuss the positive and negative aspects of solar energy in relation to natural and human aspects	PO1/PO2/PO4/PSO2 /PSO4	U

### CO -PO-PSO Mapping - REG5CRT0219 RENEWABLE ENERGY-XIII SOLAR PHOTOVOLTAIC ENERGY CONVERSION-II

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	3	1	2	1	3	-	1
CO2	2	3	-	1	-	3	2	-
CO3	2	2	-	1	2	2	-	-
CO4	2	3	2	1	-	3	3	-
CO5	2	1	-	2	-	2	-	3
AVG CO	2.0	2.4	1.5	1.4	1.5	2.6	2.5	2



**REG5CRP0119-ADVANCED SOLAR PHOTOVOLTAIC LAB**

CO	CO Statement	PO/ PSO	CL
CO1	Collect basic knowledge in solar photo voltaic system operations.	PO1,PO3,PO4 / PSO1,PSO2,PSO4	A
CO2	Analyze photovoltaic system performance and design.	PO1,PO2,PO3 / PSO1,PSO2	An
CO3	Understand advanced measurement technology, usage of new instruments.	PO1,PO3,PO4 / PSO3,PSO4	U
CO4	Analyze the relationship between current and voltage at various cell characteristics	PO1/PO2/PO3/PS O1/PSO2/PSO4	An
CO5	Understand the relationship between current and voltage for various module combination	PO1/PO2/PO3/PS O1/PSO2/PSO4	U

**CO -PO-PSO Mapping - REG5CRP0119: ADVANCED SOLAR PHOTOVOLTAIC LAB**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	-	2	1	1	2	-	1
CO2	2	2	2	-	2	1	-	-
CO3	2	-	2	2	-	-	2	2
CO4	2	1	2	-	2	1	-	3
CO5	1	2	1		1	2		2
<b>AVG CO</b>	<b>1.8</b>	<b>1.6</b>	<b>1.8</b>	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>	<b>2</b>	<b>2</b>

**REG5CRP0219 ADVANCED SOLAR THERMAL LAB-I**

CO	CO Statement	PO/ PSO	CL
CO1	Experimental investigations of solar thermal systems and understand the implications of the results.	PO1/PO2/PO3/ PO4/PSO1/PSO2 /PSO3/ PSO4	An
CO2	Estimate the system efficiency and heat loss of a parabolic trough solar concentrator.	PO1/PO2/PO3/ PO4/PSO1/PSO2 /PSO3/ PSO4	E
CO3	To study the effect of change in parameters such as wind speed, irradiation and ambient temperature	PO1/PO2/PO3/ PO4/PSO1/PSO2 /PSO3/ PSO4	An
CO-4	To understand and compare the pressure in various tubes with design values	PO1/PO2/PO3 /PO4/PSO1/PSO2 /PSO3/ PSO4	E
CO5	To determine performance of collector with various parameters	PO1/PO2/PO4/ PSO1/PSO4	U

**CO -PO-PSO Mapping - COURSE NAME: REG5CRP0219 ADVANCED SOLAR THERMAL LAB-I**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	1	1	2	1	1	3	3	3
CO2	1	1	2	1	1	3	3	3
CO3	2	2	1	2	2	1	2	1
CO4	1	1	1	3	2	1	1	1
CO5	2	1	-	2	1	-	-	2
AVG CO	1.4	1.2	1.5	1.8	1.4	2.0	2.25	2.0

**SEMESTER VI****RPH6CMT0119-PHYSICS-V - SPECTROSCOPY AND EXPERIMENTAL TECHNIQUES**

CO	CO Statement	PO/ PSO	CL
CO1	Discuss the basic elements of spectroscopy	PO1,PO2,PO3, PO4 / PSO1	U
CO2	Identify various spectroscopic techniques	PO1,PO2,PO3 / PSO1, PSO2	R
CO3	Discover the recent advances in vacuum science and applications	PO1,PO3,PO4 / PSO1, PSO3	A
CO4	Organize the knowledge towards recent advances in spectroscopy	PO1,PO3,PO4 /PSO3	An
CO5	Apply the spectroscopic techniques in renewable energy production area	PO1,PO4 / PSO3,PSO4	A

**CO -PO-PSO Mapping - RPH6CMT0119- PHYSICS-V - SPECTROSCOPY AND EXPERIMENTAL TECHNIQUES**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	2	1	1	2	-	-	-
CO2	1	1	2	-	1	2	-	-
CO3	2	-	1	1	2	-	1	-
CO4	2	-	1	2	-	-	2	-
CO5	1	-	-	3	-	-	2	1
AVG CO	1.60	1.50	1.25	1.75	1.66	2.00	1.66	1.00

**RPH6CMT0219-PHYSICS-VI: POWER ELECTRONICS**

CO	CO Statement	PO/ PSO	CL
CO1	Recall types of FET, its use and applications	PO1,PO2,PO3 / PSO2	R
CO2	Analyze the construction and operation of Thyristors, SCR, DIAC, TRIAC	PO1,PO2 / PSO2, PSO3	An
CO3	Describe the purpose and operation of UJT and SCS	PO1,PO2,PO3, PO4 / PSO3.PSO4	U
CO4	Discuss the operation and characteristics of controlled rectifiers	PO1,PO2,PO4 / PSO4	U
CO5	Apply the theory and operating principles in conversion and control of electric power from renewable energy sources	PO3,PO4 / PSO2,PSO4	A

**CO -PO-PSO Mapping - COURSE NAME: RPH6CMT0219--PHYSICS-VI: POWER ELECTRONICS**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	2	1	-	-	2	-	-
CO2	1	1	-	-	-	1	2	-
CO3	2	1	2	1	-	-	1	2
CO4	2	1	-	2	-	-	-	2
CO5	-	-	1	2	-	2	-	1
AVG CO	1.75	1.25	1.33	1.66	-	1.66	1.50	1.66

**REG6CMT0119- RENEWABLE ENERGY-XIV: FUEL CELL SYSTEMS AND HYDROGEN**

CO No.	Course Outcomes	PSOs	Cognitive Level
CO1	Explain the basics of fuel cells	PO1,PO2,PO4/ PSO1,PSO2, PSO4	U
CO2	Discuss the various types of fuel cells	PO1,PO3,PO4/ PSO1,PSO2	U
CO3	Illustrate the properties of hydrogen and its production	PO1,PO3,PO4/ PSO1,PSO2, PSO3,PSO4	U
CO4	Describe the storage and various application of hydrogen	PO1,PO3,PO4/ PSO2,PSO3, PSO4	U
CO5	Apply the different hydrogen production and storage techniques from renewable energy sources while reducing operating and capital costs.	PO1,PO4/PSO4	A

**CO -PO-PSO Mapping - RENEWABLE ENERGY-XIV: FUEL CELL SYSTEMS AND HYDROGEN**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	1	-	3	1	2	-	2
CO2	2	-	2	2	1	2	-	-
CO3	2	-	1	3	2	2	1	3
CO4	1	-	2	2	-	1	2	3
CO5	1	-	-	2	-	-	-	1
AVG CO	1.60	1.00	1.66	2.40	1.33	1.75	1.50	2.25

**REG6CRT0120: BRENEWABLE ENERGY-XV: ENERGY MANAGEMENT AND AUDITING AND AUDITING**

CO No.	Course Outcomes	PO/PSOs	Cognitive Level
CO1	Understand the Indian energy scenario, energy policies, pricing and reforms	PO1,PO2, PO3, PO4/PSO1,PSO2, PSO3, PSO4	U
CO2	Understand the importance of implementing energy audits as part of energy efficiency and conservation exercise	PO2, PO3/PSO1, PSO3, PSO4	U
CO3	Develop a platform for the implementation of energy saving measures based on the energy audit report outcome	PO1,PO2, PO3,PO4/ PSO1,PSO2,PSO4	A
CO4	Analyze the quality of measuring instruments	PO2, PO3,PO4/ PSO1,PSO3,PSO4	An
CO5	Explain the implementation of energy saving measures based on the energy audit report outcome	PO1,PO4/PSO4	U

**CO -PO-PSO Mapping- RENEWABLE ENERGY-XV: REG6CRT0120 ENERGY MANAGEMENT AND AUDITING**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	2	3	1	2	3	2	2	3
CO2	-	2	3	-	2	-	3	2
CO3	2	2	2	3	1	3	-	2
CO4	-	1	2	2	2	-	3	1
CO5	1	-	-	2	-	-	-	2
AVG CO	1.66	2.00	2.00	2.25	2.00	2.50	2.66	2.00

**REG6CRP0119 ADVANCED SOLAR THERMAL LAB-II**

CO	CO Statement	PO/ PSO	CL
CO1	Experimental investigation of solar thermal systems and understand the implications of the results.	PO1,PO3,PO4/ PSO2,PSO3, PSO4	An
CO2	Estimate the charging period and discharging period of heat transfer fluid.	PO2,PO3,PO4/ PSO2,PSO3, PSO4	E
CO3	To study the performance analysis of paraffin wax based latent heat thermal energy storage systems with different heat exchangers	PO1,PO2,PO4/ PSO1,PSO3, PSO4	An
CO4	To do the performance analysis of a Fatty acid based thermal energy storage system with different insulating materials: an experimental study	PO2,PO3,PO4/ PSO1,PSO2, PSO4	E
CO5	To collaborate with industry and research field	PO3,PO4/PSO3, PSO4	C

**CO -PO-PSO Mapping - COURSE NAME: REG6CRP0119 ADVANCED SOLAR THERMAL LAB-II**

	PO1	PO2	PO3	PO4	PS01	PSO2	PSO3	PSO4
CO1	1	-	2	1	-	3	2	1
CO2	-	1	2	1	-	3	1	3
CO3	2	1	-	2	2	-	2	1
CO4	-	1	1	3	2	1	-	1
CO5	-	-	2	3	-	-	2	1
AVG CO	1.50	1.00	1.75	2.00	2.00	2.33	1.75	1.40

**REG6CRP0219: PRACTICAL – EXPERIMENTAL TECHNIQUES & POWER ELECTRONICS**

CO	CO Statement	PO/ PSO	CL
CO1	Develop power semiconductor circuits to electrical power system.	PO1,PO2,PO3, PO4/PSO1, PSO2,PSO3,PSO4	A
CO2	Examine firing circuit for Thyristors.	PO2,PO3/PSO1	A
CO3	Develop power semiconductor circuits to electrical power system.	PO1,PO2,PO3, PO4/PSO1, PSO2,PSO3,PSO4	A
CO4	Analyze the operation of converters.	PO1,PO2,PO3, PO4/PSO1, PSO2,PSO3,PSO4	An
CO5	Describe the control in grid connected renewable energy systems	PO3,PO4/PSO2, PSO3,PSO4	U

**CO -PO-PSO MAPPING - REG6CRP0219: PRACTICAL – EXPERIMENTAL TECHNIQUES & POWER ELECTRONICS**

	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO-4
CO1	3	2	2	2	2	1	3	2
CO2	1	3	3	1	3	2	2	1
CO3	3	1	2	2	2	2	2	3
CO4	2	2	2	3	2	3	2	3
CO5	-	-	2	2	-	1	2	1
AVG CO	2.25	2.00	2.20	2.00	2.25	1.80	2.20	2.00



**PROGRAMME ARTICULATION MATRIX**

Name of the course	Semester	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
RMA1CMT0119: MATHEMATICS-I	1	2.4	2.6	1.33	1.67	1.8	2	1.75	1.67
REG1CMT0119: FUNDAMENTALS OF COMPUTER	1	2	2.2	1.6	1.75	2	2	1.75	2
RPH1CRT0119- PHYSICS-I: UNITS AND MEASUREMENTS, CIRCUIT THEORY AND ELECTRICAL FUNDAMENTALS	1	1.6	2.4	1.75	2.33	2	2	-	
REG1CRT0119: RENEWABLE ENERGY I- FUNDAMENTALS OF SUSTAINABLE ENERGY & DEVELOPMENT	1	2	1.8	1.5	2.8	1.5	2.6	-	1.5
REG1CRP0119- GENERAL PHYSICS LAB	1	2	2	2	2	2	1.75	1.66	-
REG1CRP0219: COMPUTER APPLICATION LAB - MATLAB	1	1.6	2.4	2.4	1.6	1.6	1.8	2	1
RMA2CMT0119: MATHEMATICS-II	2	2.2	2.6	1.5	1.67	2.4	1.33	1.33	1.2
RPH2CMT0119: PHYSICS-II BASIC ELECTRONICS	2	1.6	1.4	1.2	1.6	1.8	1.4	1.2	1

REG2CRT0119- RENEWABLE ENERGY-II: PHYSICO- CHEMICAL PROCESSES FOR WATER AND WASTEWATER TREATMENT	2	2.2	1.5	1.75	1.5	3	2	2	2
REG2CRT0219 RENEWABLE ENERGY-III: PHOTOVOLTAIC MODULE INSTALLATION	2	2	4.5	2	1.5	2.33	1.67	2.5	2
REG2CRP0119 PRACTICAL- ELECTRONICS & PHOTOVOLTAIC MODULE INSTALLATION	2	1.5	2.7	2	1.5	2.6	2.6	2.4	1
RCH3CMT0119- CHEMISTRY-II: PHYSICAL CHEMISTRY	3	1.8	2	1.33	2.5	2.33	2	2	2
RPH3CMT0119- PHYSICS-III: THERMODYNAMICS & FLUID MECHANICS	3	2	2.25	2.33	2	2.25	1.5	1.5	2
REG3CRT0119: RENEWABLE ENERGY-IV NOVEL ENERGY RESOURCES	3	1.6	1.25	1.6	2	1.33	1.5	2	2
REG3CRT0219 RENEWABLE ENERGY-V: SOLAR THERMAL TECHNOLOGY-I	3	1.6	2	1.66	3	1.6	1.8	2.5	1.75

REG3CRT0220: RENEWABLE ENERGY-VI: WIND ENERGY	3	2	2.5	2	2.75	1.8	1	1.5	2.25
REG3CRP0119: THERMODYNAMICS AND SOLAR THERMAL	3	1.25	1.25	1.6	1.75	1.25	2	2.25	2
REG3CRP0219 PRACTICAL- FLUID DYNAMICS AND WIND ENERGY	3	2	2	1.8	2	2	2.4	1.5	2.25
REG4CRT0119 RENEWABLE ENERGY-VII: SOLAR THERMAL TECHNOLOGY-II	4	2	2	3	2	1.6	1.8	1.8	1.8
REG4CMT0119- MATERIAL SCIENCE	4	2	1.6	1.33	1.6	2	1.5	1.5	1.5
REG4CMT0219 ENVIRONMENTAL EDUCATION	4	1.6	1.2	1.5	2.2	1.66	1.4	1.66	2
REG4CRT0119 RENEWABLE ENERGY-VIII: SOLAR PHOTOVOLTAIC ENERGY CONVERSION-I	4	1.6	2.2	1.33	1.67	1.33	2.8	1.75	1.67
REG4CRT0220: RENEWABLE ENERGY-IX: ENERGY STORAGE SYSTEMS	4	2	2	2.75	2.2	2	2	2.5	2
REG4CRP0119 PRACTICAL- SOLAR PHOTOVOLTAIC & ENERGY STORAGE SYSTEMS	4	1.8	1.4	1.8	1.5	1	2.25	1.67	1.6

REG1CMT0120: LASER AND OPTICAL INSTRUMENTS	5	2.25	2.6	2.0	1.75	2.3	2.0	2.5	1.5
REG5CMT0119: RENEWABLE ENERGY-X- ENVIRONMENT, HEALTH & SAFETY IN INDUSTRIES	5	1.8	1.25	2.0	2	3.0	2.0	2.25	2.0
REG5CMT0219: RENEWABLE ENERGY-XI: PROJECT MANAGEMENT	5	2.75	1.6	1.75	1.25	1.3	1.25	2.4	1.5
REG5CRT0120 XII: ENERGY CONSERVATION TECHNIQUES	5	2.2	2.0	2.0	2.4	2.5	2.0	2.5	2.2
REG5CRT0219 RENEWABLE ENERGY-XIII SOLAR PHOTOVOLTAIC ENERGY CONVERSION-II	5	2.0	2.4	1.5	1.4	1.5	2.6	2.5	2
REG5CRP0119- ADVANCED SOLAR PHOTOVOLTAIC LAB	5	1.8	1.6	1.8	1.5	1.5	1.5	2	2
REG5CRP0219 ADVANCED SOLAR THERMAL LAB-I	5	1.4	1.2	1.5	1.8	1.4	2.0	2.25	2.0
RPH6CMT0119- PHYSICS-V - SPECTROSCOPY AND EXPERIMENTAL TECHNIQUES	6	1.60	1.50	1.25	1.75	1.66	2.00	1.66	1.00

RPH6CMT0219- PHYSICS-VI: POWER ELECTRONICS	6	1.75	1.25	1.33	1.66	-	1.66	1.50	1.66
REG6CMT0119- RENEWABLE ENERGY-XIV: FUEL CELL SYSTEMS AND HYDROGEN	6	1.60	1.00	1.66	2.40	1.33	1.75	1.50	2.25
REG6CRT0120: BRENEWABLE ENERGY-XV: ENERGY MANAGEMENT AND AUDITING AND AUDITING	6	1.66	2.00	2.00	2.25	2.00	2.50	2.66	2.00
REG6CRP0119 ADVANCED SOLAR THERMAL LAB-II	6	1.50	1.00	1.75	2.00	2.00	2.33	1.75	1.40
REG6CRP0219: PRACTICAL – EXPERIMENTAL TECHNIQUES & POWER ELECTRONICS	6	2.25	2.00	2.20	2.00	2.25	1.80	2.20	2.00



# St. Albert's College (Autonomous)

An initiative of Educational and Charitable Trust of Archdiocese of Verapoly

Banerji Road, Ernakulam, Kochi - 682018 Kerala, India | Office: 0484-2394225  
Fax: 0484- 2391245 | website : [www.alberts.edu.in](http://www.alberts.edu.in)