



**DEPARTMENT OF CHEMISTRY**  
**MUHAMMED ABDURAHIMAN MEMORIAL**  
**ORPHANAGE (MAMO) COLLEGE**

[Govt. Aided First Grade College & Affiliated to University of Calicut.  
Re-Accredited by NAAC with A Grade]

**CURRICULUM FOR CERTIFICATE COURSE**  
**CERCH005: RENEWABLE SOURCES**  
**OF ENERGY**

**OFFERED DURING THE**  
**ACADEMIC YEAR 2018-19**  
**[APPROVED BY ACADEMIC COMMITTEE, MAMO COLLEGE]**



MANASSERY, MUKKAM POST,  
KOZHIKODE, KERALA, INDIA, 673 602.  
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## DEPARTMENT OF CHEMISTRY

### CURRICULUM FOR CERTIFICATE COURSE - CERCH005

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## INSTITUTIONAL VISION, MISSION & OBJECTIVES 01



VISION

**VISION:** Build Scientifically Oriented, Intellectually Accomplished, Morally Upright and Socially Committed youth who can play a constructive role in Nation Building.



MISSION

**MISSION:** Intellectual, social and economic empowerment of the youth in general and women, minorities, orphans and the destitute in particular by providing quality, value-based higher-education.



OBJECTIVES

**OBJECTIVES:** Pursuit of Excellence, Harnessing technology, Thrust on value-based education, Nurturing Excellence and Moulding the youth for Nation Building



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## VISION, MISSION, OBJECTIVES & CORE VALUES OF THE DEPARTMENT 02



VISION

**VISION:** To be a recognized model for educating students, prepared to compete in and contribute to the ever-changing, technology-centred world.



MISSION

**MISSION:** To encourage in the broadest and most liberal manner towards the advances in Chemistry through education by providing students with quality education.



**OBJECTIVES:** (a) To provide a broad foundation in Chemistry that stresses scientific reasoning and analytical problem solving with molecular perspective. (b) To provide students with skills required to perform laboratory experiments and data analysis. (c) Provide programmes that meet the educational and technical demands of the sub-disciplines. (d) Value-based training for ethical Conscience. (e) Inculcate critical and analytical thinking. (f) Apply fundamental chemical principles to gather and explain data.



VALUES

**CORE VALUES:** Innovation, Excellence, Ethical Consciousness, Service Mindedness, Professionalism and Global Outlook.



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## B.Sc. POLYMER CHEMISTRY: PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) 03

After 4 to 5 years of graduation, the career and professional accomplishments attained by the B.Sc Polymer Chemistry Graduates would reflect that the programme really prepared the graduates to deal with the real world, where they could apply and use the skills and knowledge they have learned to good use.

Specifically, the graduate would be able to:



**PEO1:** Acquire the fundamental principles of Science and Chemistry with modern experimental and computational skills.



**PEO2:** Ability to handle problems of practical relevance to society while complying with economical, ethical and safety factors.



**PEO3:** Demonstrate professional excellence, ethics, soft skills and leadership qualities.



**PEO4:** Have sufficient breadth of understanding to enable continued professional development and lifelong learning throughout their career.



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# B.Sc POLYMER CHEMISTRY: PROGRAMME SPECIFIC OUTCOME (PSOs) 04

On successful completion of a Bachelor Degree in Polymer Chemistry, the graduates would be able to:

-  **PSO1:** Gain the knowledge of Chemistry through theory and hands-on training.
-  **PSO2:** To explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions.
-  **PSO3:** To familiarize with the emerging areas of Chemistry and their applications and to apprise the students of its relevance in future studies.
-  **PSO4:** Understand good laboratory practices and safety.
-  **PSO5:** To be conversant with the applications of Chemistry in day-to-day life.



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# B.Sc POLYMER CHEMISTRY: PROGRAMME OUTCOMES (POs) 05

The students graduating from B.Sc Polymer Chemistry Programme should be able to:



**PO1:** Demonstrate, solve and an understanding of major concepts in all Disciplines of chemistry problems.



**PO2:** Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.



**PO3:** Create an awareness of the impact of chemistry on the environment, society, and development outside the scientific community.



**PO4:** Find out the green route for chemical reaction for sustainable development.



**PO5:** To inculcate the scientific temperament in the students and outside the scientific community.



**PO6:** Use modern techniques, recent equipment and software for leaning Chemistry.



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**PO7:** To demonstrate professional and ethical attitude with enormous responsibility to serve the society.



**PO8:** To apply contextual knowledge and modern tools of chemistry research for solving problems.



**PO9:** An understanding of professional, ethical, legal, security, social issues and responsibility.



**PO10:** Be acquainted with the contemporary issues latest trends in technological development and thereby innovate new ideas and solutions to existing problems.



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## CERTIFICATE COURSE

# CERCH005: RENEWABLE SOURCES OF ENERGY **06**

## COURSE CURRICULUM

Course Name	Renewable Sources of Energy
Course Code	CERCH005
Year	2018-19
Course Designer	Ms. Minnath T. A
Course Duration	30 Hrs
Course Schedule	June to September
Maximum Students Intake	60 Students



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#### 1. COURSE LEVEL

Fundamental, skill-oriented certificate/vocational programme.

#### 2. PREREQUISITE

Basic of Physics, Chemistry and Mathematics.

#### 3. COURSE INTAKE & ADMISSION

Maximum 60 students will be given admission to the course based on First-Come-First-Serve basis. All the students of the MAMO College are eligible for free enrolment for the course. The enrolment notification will be issued for the course well in advance of the commencement of the course.

#### 4. COURSE COORDINATOR

Ms. Minnath. T. A, Assistant Professor, Department of Chemistry

#### 5. COURSE PREAMBLE

Modern world aims to replace computer for human works. Each and every field uses computer to reduce the work burden. Any real world problem can be solved using computers most effectively. The areas like weather forecast, construction, medical, business, marketing, education, entertainment, transportation, etc., make use of computers for better serving the beneficiaries. To solve the real-world problem through programming in an efficient manner, students must develop the problem solving and logical mentality by formally learning the problem types and problem solving strategies. This course provides adequate knowledge to solve the problems and problem solving strategies in respective domains



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#### 6. DURATION

Total Duration: 30 Hrs. [Contact Hrs. 18 Hrs., Course Works: 6 and Assessment Works: 6]

#### 7. CURRICULUM FOCUS

Enhance the employability of the learners through curriculum enrichment for additional skill development.

#### 8. COURSE OBJECTIVES

Learners are expected to

- Have awareness about sources of energy and able to estimate how long the available conventional fuel reserves will last.
- Learn the fundamental concepts about solar energy systems and devices, energy from ocean, know about Biomass energy, mini-micro hydro systems and geothermal energy system.

#### 9. SKILL EXPECTED

On the successful completion of the course, learners will be able to:

- Gain knowledge about working principle of various solar energy systems

#### 10. COURSE OUTCOMES

Upon the successful completion of the course, learners will be able to:



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CO No	Course Outcome(CO)	Skill/Knowledge Attainment Level Based on Revised Bloom's Taxonomy
CO1	Understand of renewable and non-renewable sources of energy	Understand
CO2	Gain knowledge about working principle of various solar energy systems	Learn
CO3	Understand the applications of different renewable energy sources like ocean thermal, hydro, geothermal energy etc.	Apply

## 11. MAPPING OF COs WITH PSO<sub>s</sub> AND PO<sub>s</sub>

CO <sub>s</sub>	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	2	1	1	0	1	0	2	2	2	0	2	0	2
CO2	2	1	2	1	1	1	0	1	2	1	2	0	2	0	2
CO3	2	1	2	2	1	1	1	1	2	2	2	0	2	0	2
AVG	2.0	1.0	2.0	1.3	1.0	0.7	0.7	0.7	2.0	1.7	2.0	0.0	2.0	0.0	2.0

## 12. MODULE-WISE COURSE CONTENTS

### MODULE 1: INTRODUCTION TO ENERGY STUDIES

**MODULE DURATION:** 10 Hrs. [Contact Hrs. 6 Hrs., Course Woks: 2 and Assessment Works: 2]



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### CURRICULUM FOR CERTIFICATE COURSE - CERCH005

**MODULE CONTENT:** Introduction, Energy science and Technology, Forms of Energy, Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption, Roles and responsibility of Ministry of New and Renewable Energy Sources, Needs of renewable energy, Classification of Energy Resources, Conventional Energy Resources, NonConventional Energy Resources, World Energy Scenario, Indian Energy Scenario.

**MODULE OUTCOME:** Understand of renewable and non-renewable sources of energy

### MODULE 2: SOLAR ENERGY

**MODULE DURATION:** 10 Hrs. [Contact Hrs. 6 Hrs., Course Woks: 2 and Assessment Works: 2]

**MODULE CONTENT:** Introduction, Solar Radiation, Principle of Conversion of Solar Radiation into Heat, Collectors, Collector efficiency, Selective surfaces, Solar Water Heating system, Solar Cookers , Solar driers, Solar Still, Solar Furnaces, Solar Greenhouse. Solar Photovoltaic, Solar Cell fundamentals, Characteristics, Classification, Construction of module, panel and array. Solar PV Systems (stand-alone and grid connected), Solar PV Applications. Government schemes and policies

**MODULE OUTCOME:** Gain knowledge about working principle of various solar energy systems

### MODULE 3: HYDRO POWER AND OTHER RENEWABLE ENERGY SOURCES

**MODULE DURATION:** 10 Hrs. [Contact Hrs. 6Hrs., Course Woks: 2 and Assessment Works: 2]

**MODULE CONTENT:** Hydropower: Introduction, Capacity and Potential, Small hydro, Environmental and social impacts. Tidal Energy: Introduction, Capacity and Potential, Principle of Tidal Power, Components of Tidal Power Plant, Classification of Tidal Power Plants. Ocean Thermal Energy:



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Introduction, Ocean Thermal Energy Conversion (OTEC), Principle of OTEC 5 system, Methods of OTEC power generation. Geothermal Energy: Introduction, Capacity and Potential, Resources of geothermal energy.

**MODULE OUTCOME:** Understand the applications of different renewable energy sources like ocean thermal, hydro, geothermal energy etc.

#### REFERENCES:

1. Sukhatme. S. P., *Solar Energy*, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
2. B. H. Khan, *Non-Conventional Energy Resources*, The McGraw Hill
3. Twidell, J. W. & Weir, A. *Renewable Energy Sources*, EFN Spon Ltd., UK, 2006.
4. S. P. Sukhatme and J. K. Nayak, *Solar Energy – Principles of Thermal Collection and Storage*, Tata McGraw-Hill, New Delhi.
5. Garg, Prakash, *Solar Energy, Fundamentals and Applications*, Tata McGraw Hill.

#### ADDITIONAL REFERENCES & STUDY MATERIALS:

6. G.D. Rai, *Non-Conventional Energy Sources*, Khanna Publications, New Delhi, 2011.
7. Godfrey Boyle, *Renewable Energy, Power for a Sustainable Future*, Oxford University Press, U.K., 1996.
8. Khandelwal, K.C., Mahdi, S.S., *Biogas Technology – A Practical Handbook*, Tata McGraw-Hill, 1986.
9. Tiwari. G.N., *Solar Energy – Fundamentals Design, Modelling & Applications*, Narosa Publishing House, New Delhi, 2002.
10. Freris. L.L., *Wind Energy Conversion Systems*, Prentice Hall, UK, 1990.



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11. Frank Krieth & John F Kreider, *Principles of Solar Energy*, John Wiley, New York

### 13. DELIVERY MODE

The course employs multi-mode delivery mechanism including contact lecture, online videos, and online and offline course works.

### 14. DELIVERY SCHEDULE

June to September.

### 15. DETAILED COURSE DELIVERY PLAN

Hour	Delivery Mode and Activity	Topics to be Covered
1	Contact Hour - 1: Classroom Discussion	Introducing the Course
2	Contact Hour - 2: Classroom Demonstration	Energy science and Technology, Forms of Energy,
3	Contact Hour - 3: Classroom Demonstration	Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption
4	Contact Hour - 4: Classroom Demonstration	Roles and responsibility of Ministry of New and Renewable Energy Sources, Needs of renewable energy.
5	Contact Hour - 5: Classroom Demonstration	Classification of Energy Resources, Conventional Energy Resources and Non-Conventional Energy Resources.
6	Contact Hour - 6: Classroom Demonstration	World Energy Scenario, Indian Energy Scenario.



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Hour	Delivery Mode and Activity	Topics to be Covered
7	Course Work – 1: Course Assignment	Course Assignment on Importance of Non conventional energy resources.
8	Assessment Hour - 1	Quiz on Module 1
9	Course Work – 2: Course Assignment	Assignment on World Energy Scenario and Indian Energy Scenario.
10	Assessment Hour - 2	Test on Module 1
11	Contact Hour - 7: Classroom Demonstration	Solar Radiation, Principle of Conversion of Solar Radiation into Heat.
12	Contact Hour - 8: Classroom Demonstration	Collectors, Collector efficiency, Selective surfaces, Solar Water Heating system, Solar Cookers
13	Contact Hour - 9: Classroom Demonstration	Solar driers, Solar Still, Solar Furnaces, Solar Greenhouse
14	Contact Hour - 10: Classroom Demonstration	Solar Photovoltaic, Solar Cell fundamentals, Characteristics, Classification
15	Contact Hour - 11: Classroom Demonstration	Solar PV Systems
16	Contact Hour - 12: Classroom Demonstration	Solar PV Applications. Government schemes and policies.
17	Course Work – 3 Course Assignment	Assignment on Solar PV Systems
18	Course Work – 4 Course Assignment	Assignment on working principle of various solar energy systems.
19	Assessment Hour - 3	Quiz on module 2
20	Assessment Hour - 4	Test on Module 2



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Hour	Delivery Mode and Activity	Topics to be Covered
21	Contact Hour - 13: Classroom Demonstration	Hydropower: Introduction, Capacity and Potential, Small hydro, Environmental and social impacts., ,
22	Contact Hour - 14: Classroom Demonstration	Tidal Energy: Introduction, Capacity and Potential. Classification of tidal power plants.
23	Contact Hour - 15: Classroom Demonstration	Principle of Tidal Power, Components of Tidal Power Plant.
24	Contact Hour - 16: Classroom Demonstration	Ocean Thermal Energy: Introduction, Ocean Thermal Energy Conversion (OTEC),.
25	Contact Hour - 17: Classroom Demonstration	Principle of OTEC 5 system, Methods of OTEC power generation
26	Contact Hour - 18: Classroom Demonstration	Geothermal Energy: Introduction, Capacity and Potential, Resources of geothermal energy.
27	Course Work – 5 Course Assignment	Assignment on the methods of OTEC Power generation.
28	Course Work – 6 Course Assignment	Assignment on The resources of geothermal energy
29	Assessment Hour - 5	Course End Assessment
30	Assessment Hour - 6	Course End Assessment

## 16. ASSESSMENT COMPONENTS

Total Marks: 100

**CLASSROOM AND GROUP PARTICIPATION: 20 Marks.** This component aims at testing the course content understanding and the reflection skills and



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Principal: 0495-2295121



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**COORDINATOR**  
**ACADEMIC COMMITTEE**  
MUHAMMED ABDURAHIMAN MEMORIAL  
ORPHANAGE COLLEGE  
P.O. MANASSERY, MUKKAM - 673602



# MUHAMMED ABDURAHIMAN MEMORIAL ORPHANAGE (MAMO) COLLEGE

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## DEPARTMENT OF CHEMISTRY

### CURRICULUM FOR CERTIFICATE COURSE - CERCH005

their attainment levels.

**COURSE WORK: 30 Marks.** This component aims at testing the skill attainment levels of the learners in analysing and implementing the real-world problem.

**MID-COURSE ASSIGNMENT: 20 Marks.** This component aims at testing the module-wise attainment levels of the course objectives and course outcome and module outcomes.

**END-COURSE ASSESSMENT: 30 Marks.** This component aims at testing overall attainment levels of the course with respect to course objectives, course outcome and module outcomes.

## 17. COURSE EVALUATION & GRADING

The course evaluation is done/coordinated entirely by the course coordinator. The following 10-point Indirect Grading System is used for awarding grades to students:

Percentage of Mark	Letter Grade	Interpretation	Class
95 and above	O	Outstanding	First Class with Distinction
85 to below 95	A+	Excellent	First Class with Distinction
75 to below 85	A	Very good	First Class with Distinction
65 to below 75	B+	Good	First Class
55 to below 65	B	Satisfactory	First Class
45 to below 55	C	Average	Second Class
35 to below 45	P	Pass	Third Class
Below 35	F	Failure	Fail
Incomplete	I	Incomplete	Fail
Absent	Ab	Absent	Fail



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The grade is awarded by the course-coordinator by considering the overall performance of the learner in all the assessment component of the course.

### 18. GRIEVANCE REDRESSAL

The grievances, if any, can be submitted to the Head of the Department for its redressal. Those grievances that cannot be redressed by HoD can be forwarded to Academic Council of the College for final decision on the matter.

### 19. ISSUANCE OF CERTIFICATES

The Course Completion Certificate will be issued to all the successful candidates showing the Total Marks and Grade Obtained.



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