



**DEPARTMENT OF MICROBIOLOGY**  
**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 IN**

**CERMB007: BIO-CHEMICAL**  
**PRINCIPLE OF ENERGY**  
**METABOLISM**

**OFFERED DURING THE**  
**ACADEMIC YEAR 2019-20**  
**[APPROVED BY ACADEMIC COMMITTEE, MAMO COLLEGE]**



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## DEPARTMENT OF MICROBIOLOGY

### CURRICULUM FOR CERTIFICATE COURSE - CERMB007

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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 brim the upcoming generation with Scientific Knowledge.



MISSION

**MISSION:** Providing quality education and training to bring out the very best in students through the stimulus of scholarly progression and intellectual development.



**OBJECTIVES:** (a) Empowerment of the students with scientific background and the technical skills, (b) Empower the students to be an entrepreneur in the field of Microbiology and allied areas.



VALUES

**CORE VALUES:** Accountability, Communication, inclusivity, innovation, Industrial excellence, Professionalism, Teamwork and tolerance.



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## B.Sc MICROBIOLOGY: PROGRAMME EDUCATIONAL OBJECTIVES [PEOs] 03

After 4 to 5 years of graduation, the career and professional accomplishments attained by the Microbiology 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:** Pursue any of the following three alternatives: (i) immediately take up a career in any area of Microbiology and work productively as a successful microbiologist in diverse career paths including supportive and leadership roles on multidisciplinary teams. (ii) Broaden the scope of the career path by pursuing higher studies and research in the field of Microbiology. (iii) Go for taking up the challenge and spearheads start-ups by positively exploiting the diverse potentials of the microbiological field.



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**PEO2:** Graduates will communicate effectively, recognize and incorporate societal needs and constraints in their professional endeavours, and practise their profession with high regard to legal and ethical responsibilities.



**PEO3:** Be original, creative, innovative and systematic in their all endeavours, including individual, collaborative and entrepreneurial ventures with meticulous strategic thinking, planning and execution.



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



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# B.Sc MICROBIOLOGY: PROGRAMME SPECIFIC OUTCOME [PSOs] 04

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



**PSO1:** The students able to understand the theoretical knowledge in the field of microbiology like general, analytical, clinical, food and industrial sectors.



**PSO2:** The students able to expertise in applying practical knowledge in medical, biochemical and industrial sectors.



**PSO3:** The students acquire research knowledge in industrial training and summative projects.



**PSO4:** The students able to analyse socially acceptable solutions to complex environmental problems with applications of modern and appropriate techniques for sustainable development.



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**PSO5:** The students able to create bio products like microbial inoculums, biologically active compounds and probiotics.



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# B.Sc MICROBIOLOGY: PROGRAMME OUTCOMES [POs] 05

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



**PO1: SCIENTIFIC & COMPUTING KNOWLEDGE:** Apply scientific and practical methods to analyse microorganisms from different sources.



**PO2: PROBLEM ANALYSIS:** Identify, formulate, review research literature, and analyze complex real-life problems reaching substantiated conclusions using first principles of statistics, natural sciences, and bioinformatics.



**PO3: DESIGN/DEVELOPMENT OF SOLUTIONS:** Design solutions for complex real-life problems or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.



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**PO4: CONDUCT INVESTIGATIONS OF COMPLEX PROBLEMS:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.



**PO5: MODERN TOOL USAGE:** Apply appropriate and modern practical techniques, resources, and modern bioinformatics software including prediction and modeling to complex biomolecules with an understanding of the limitations.



**PO6: THE MICROBIOLOGICAL PROFESSION AND SOCIETY:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practice.



**PO7: ENVIRONMENT AND SUSTAINABILITY:** Understand the impact of the environmental pollutions and their solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.



**PO8: ETHICS:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the microbiological practice.



**PO9: INDIVIDUAL AND TEAM WORK:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.



**PO10: COMMUNICATION:** Communicate effectively on complex microbial activities with the community and



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with society, such as, being able to comprehend and write effective reports and analyse the microbial activities, make effective presentations, and give and receive clear instructions.



#### **PO11: PROJECT MANAGEMENT AND FINANCE:**

Demonstrate knowledge and understanding of the microbiological principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.



**PO12: LIFE-LONG LEARNING:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of changing environment.



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## CERTIFICATE COURSE

# CERMB007: BIO-CHEMICAL PRINCIPLE OF ENERGY METABOLISM **06**

## COURSE CURRICULUM

Course Name	Bio-Chemical Principle of Energy Metabolism
Course Code	CERMB007
Year	2019-20
Course Designer	Mrs. Akmal Irfana P
Course Duration	30 Hrs
Course Schedule	June to September
Maximum Students Intake	60 Students



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#### 1. COURSE LEVEL

Foundational, skill-oriented certificate programme.

#### 2. PREREQUISITE

Fundamental knowledge in Bio chemical principles.

#### 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. Akmal Irfana P, Assistant Professor, Department of Microbiology.

#### 5. COURSE PREAMBLE

This course focuses on energy production and flow through living cells and Organisms are called bioenergetics. Energy metabolism covers various biochemical ways of energy transformation and regulatory mechanism of over thousands of chemical reactions, without fine regulation of those metabolic processes, cells and organisms cannot maintain activities linked to life. This course will introduce the fundamentals of metabolism.

#### 6. DURATION

Total Duration: 30 Hrs. [Contact Hrs. 16 Hrs, Course Woks: 7 and Assessment Works: 7]



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## 7. CURRICULUM FOCUS

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

## 8. COURSE OBJECTIVES

Learners are expected to

- To know the essentiality of energy in metabolism
- To develop an understanding how carbohydrates like glucose from your diet can be used for extracting energy

## 9. SKILL EXPECTED

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

- Establish a general concept of energy metabolism and their use in sustaining life.
- To cultivate a basic knowledge on energy metabolism in pathological condition

## 10. COURSE OUTCOMES

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

CO No	Course Outcome(CO)	Skill/Knowledge Attainment Level Based on Revised Bloom's Taxonomy
CO1	Description on energy metabolism	Understand
CO2	Examining the biochemical process involved in Energy production	Analyse



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CO No	Course Outcome(CO)	Skill/Knowledge Attainment Level Based on Revised Bloom's Taxonomy
CO3	Learn about metabolic reactions related to as well as regulatory actions among different organs	Analyse
CO4	Can learn about the importance of regulation in metabolism	Evaluate
CO5	Develop identification of dysregulated energy metabolism in pathological conditions	Analyse

## 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	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	0	1	0	1	1	1	1	1	2	2	0	1	1	1	0	1	0
CO2	1	0	2	1	0	1	1	1	2	3	1	2	1	1	2	1	1
CO3	1	1	2	1	1	1	1	1	2	0	1	2	1	1	1	1	1
CO4	1	0	2	1	1	0	1	1	2	3	1	2	1	1	2	1	1
CO5	1	1	2	1	0	1	1	1	2	0	1	2	1	1	2	1	1
AVG	0.8	0.6	1.6	1	0.6	0.8	1	1	2	1.6	0.8	1.8	1	1	1.4	1	0.8

## 12. MODULE-WISE COURSE CONTENTS

### MODULE 1: INTRODUCTION OF ENERGY METABOLISM

**MODULE DURATION:** 15 Hrs. [Contact Hrs. 8Hrs, Course works: 3 and Assessment Works: 4]



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**MODULE CONTENT:** Metabolism, energy in life, ATP the universal energy currency of cell, ATP and Muscle contraction, ATP and molecular transport, metabolic organs, hunger hormones, Carbohydrate digestion, Enzymes, Absorption of glucose.

**MODULE OUTCOME:** On successful completion of the module learners can understand the concept of energy needed and their action and formation which is more important and crucial role in the metabolism

### MODULE 2: GLUCOSE OXIDATION AND ENERGY PRODUCTION AND PHOTOSYNTHESIS

**MODULE DURATION:** 15 Hrs. [Contact Hrs. 8 Hrs., course works: 4 and Assessment Works: 3]

**MODULE CONTENT:** Overview of glucose oxidation, glycolysis, mitochondria, citric acid cycle, oxidative-phosphorylation, Photosynthesis: cyclic non cyclic and dark reaction and carbon fixation, c4 plants and CAM plants

**MODULE OUTCOME:** On successful completion of the module, whole metabolic process and their regulation which is important to understand the working mechanism of a human body using energy and can evaluate the pathological condition which may evolve by the dysfunctioning of the respected cycles.

### REFERENCES:

1. Richard Harvey & Dennis Ferrier, *Lippincott's Illustrated Reviews Biochemistry*.
2. Victor Rodwell, David Bender, Kathleen, *Harper's Illustrated Biochemistry*.
3. Satyanarayana & Chakrapani, *Biochemistry*.



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4. A. C. Deb, *Fundamentals of Biochemistry*.

#### ADDITIONAL REFERENCES & STUDY MATERIALS:

5. <https://nptel.ac.in/courses/104/105/102105034/>
6. <https://dth.ac.in/medical/courses/biochemistry/block-2/6/index.php>
7. <https://nptel.ac.in/courses/102/106/102106087/>
8. <http://www.digimat.in/nptel/courses/video/104105076/L27.html>
9. [https://www.saddleback.edu/faculty/jzoval/mypptlectures/ch15\\_metabolism/lecture\\_notes\\_ch15\\_metabolism\\_current-v2.0.pdf](https://www.saddleback.edu/faculty/jzoval/mypptlectures/ch15_metabolism/lecture_notes_ch15_metabolism_current-v2.0.pdf)

### 13. DELIVERY MODE

The course employs multi-mode delivery mechanisms including contact lecture, online MOOC courses from NPTEL, 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	Lab Hour - 1	Basic chemical analysis of biomolecules
3	Contact Hour - 2: Classroom Demonstration	Different types of metabolism and total energy obtained from each biomolecule



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Hour	Delivery Mode and Activity	Topics to be Covered
4	Contact Hour - 3: Classroom Demonstration	ATP and Muscle contraction and relaxation process
5	Contact Hour - 4: Classroom Demonstration	ATP and molecular transport and metabolic organs related
6	Contact Hour - 5: Classroom Demonstration	Hunger hormones ,enzymes and carbohydrate digestion and absorption of glucose
7	Contact Hour - 6: Classroom Demonstration	Glycolysis, mitochondria, citric acid cycle
8	Lab Hour - 2	Qualitative analysis of carbohydrates
9	Course Work – 1: Course Assignment	Course Assignment to write the total energy expenditure calculation from one glucose
10	Course Work – 2: Course Assignment	Course Assignment to study about the internal organs related to energy metabolism
11	Assessment Hour - 1	Assessment to ensure the importance of enzymes in metabolism
12	Course Work – 3: Course Assignment	Course Assignment to write about the different hormones and their physiological importance in relation to energy metabolism
13	Assessment Hour - 2	Assignment to ensure the detailed explanation on mechanism of action of hormones



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Principal: 0495-2295121

**COORDINATOR**  
**ACADEMIC COMMITTEE**  
MUHAMMED ABDURAHIMAN MEMORIAL  
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# MUHAMMED ABDURAHIMAN MEMORIAL ORPHANAGE (MAMO) COLLEGE

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## DEPARTMENT OF MICROBIOLOGY

### CURRICULUM FOR CERTIFICATE COURSE - CERMB007

Hour	Delivery Mode and Activity	Topics to be Covered
14	Contact Hour - 7: Classroom Demonstration	Photosynthesis cyclic and non-cyclic photophosphorylation and dark reaction
15	Contact Hour - 8: Classroom Demonstration	carbon fixation, C4 plants and CAM plants.
16	Lab Hour - 3	Qualitative analysis of proteins
17	Lab Hour - 4	Qualitative analysis of Lipids
18	Lab Hour - 5	Quantitative estimation of protein by Lowrys and Biurt method
19	Course Work – 4: Course Assignment	Course Assignment to write glycolysis structure and energy expenditure
20	Course Work – 5: Course Assignment	Course Assignment to write about the mitochondrial structure and explanation on different complexes
21	Lab Hour - 6	Quantitative estimation of glucose by DNS and anthrone method
22	Lab Hour - 7	Quantitative estimation of Cholesterol by Zaks method
23	Lab Hour - 8	Demonstration of biochemical technique paper chromatography and separation of amino acids
24	Assessment Hour - 3	Assignment to write mitochondrial oxidation
25	Assessment Hour - 4	Assignment to write about cyclic and non-cyclic photophosphorylation
26	Assessment Hour - 4	Assignment to write about cyclic and non-cyclic photophosphorylation



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### DEPARTMENT OF MICROBIOLOGY

### CURRICULUM FOR CERTIFICATE COURSE - CERMB007

Hour	Delivery Mode and Activity	Topics to be Covered
27	Course Work – 6: Course Assignment	Course Assignment to write the dark reaction and carbon fixation
28	Course Work – 7: Course Assignment	Course Assignment to write about C4 and CAM plants
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 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:



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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

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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