



**DEPARTMENT OF PHYSICS**  
**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**

**CERPH001: INTRODUCTION TO**  
**COMPUTATIONAL PHYSICS**

**OFFERED DURING THE**  
**ACADEMIC YEAR 2016-17**  
**[APPROVED BY ACADEMIC COMMITTEE, MAMO COLLEGE]**



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## DEPARTMENT OF PHYSICS

### CURRICULUM FOR CERTIFICATE COURSE - CERPH003

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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 build an effective and efficient scenario for the conceptually rich youth to create and revolutionize towards the overall integrity and Development of our Nation.



MISSION

**MISSION:** To provide an effective environment to enhance the scientific temperament and leadership Quality through Rationalism, critical and logic thinking in the students and thereby promoting them to be a socially committed, employable and responsible youth.



**OBJECTIVES:** (a) Emphasize the role of Physics in life. (b) Develop the ability to conduct, observe, analyzes and report an experiment and to deal with physical and mathematical models. (c) Improve the fundamental concepts and advanced techniques of Physics. (d) Enhance intellectual, computational, experimental, communication and analytical skills of the students. (e) Provide the students with the modern techniques in physics.



VALUES

**CORE VALUES:** Innovation, Quality & Excellence, Integrity, Ethical Conscience, Fairness & Justice, Service Mindedness, Professionalism, Global Outlook, Honesty and Discipline & Accountability.



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

After 4 to 5 years of graduation, the career and professional accomplishments attained by the Physics 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: COMPETENCY SKILLS:** To develop strong student competencies and its applications in a technology – rich, interactive environment.



**PEO2: ADAPTABILITY TO THE CHANGING ENVIRONMENTS:** 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.



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**PEO3: ENTHUSIASM IN RESEARCH:** To develop strong student skills in research, and interpretation of complex information.



**PEO4: SUSTAINABLE EXCELLENCE AND GROWTH IN THE CAREER:** Have sufficient breadth of understanding to enable continued professional development and lifelong learning throughout their career..



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

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



**PSO1:** Introduce advanced techniques and ideas required in developing a suitable career in life.



**PSO2:** Understand and apply principles of Physics for understanding the scientific phenomenon in the recent research realms.



**PSO3:** Developing research oriented skills and to create an awareness on the impact of Physics on the society and development outside the scientific community.



**PSO4:** Enhance the ability of the students to use Mathematical and Statistical models in solving various problems in the course of study and also to make aware and handle various sophisticated instruments/equipment.



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

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



**PO1: SCIENTIFIC TEMPER & KNOWLEDGE:** Apply knowledge of physics and its branches to provide solutions to complex problems.



**PO2: PROBLEM SOLVING CAPABILITY:** Identify, formulate, review research literature, and analyze complex real-life problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing.



**PO3: ANALYTIC SOLUTIONS:** Design practical solutions for complex real-life problems through proper case analysis and design system components 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: CRITICAL / LOGICAL THINKING:** 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: ADAPTABILITY THROUGH TECHNOLOGY:** Create, select, and apply appropriate techniques, resources, and modern computing and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.



**PO6: THE RATIONALISM 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 professional computing solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.



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



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



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**PO10: COMMUNICATION:** Communicate effectively on complex computing activities with the team members and with society at large, such as, being able to comprehend and demonstrate in simple manner, and give and receive clear instructions.



**PO11: PROJECT MANAGEMENT AND FINANCE:** Demonstrate knowledge and understanding of the scientific and reasoning 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 technological change.



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## CERTIFICATE COURSE

# CERPH001: INTRODUCTION TO COMPUTATIONAL PHYSICS **06**

## COURSE CURRICULUM

Course Name	Introduction to Computational Physics
Course Code	CERPH001
Year	2016-17
Course Designer	Mr. Shafi K. M
Course Duration	30 Hrs
Course Schedule	November to February
Maximum Students Intake	60 Students



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#### 1. COURSE LEVEL

Foundational, skill-oriented certificate programme.

#### 2. PREREQUISITE

Basic knowledge in Physics 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

Mr. Shafi K. M, Assistant Professor, Department of Physics.

#### 5. COURSE PREAMBLE

In physics, analytical methods always represent an ideal world and the computational methods becomes a necessity when we try to look at the real world. This course is designed to train students in numerical techniques that are widely used in the domain of computational physics using Python. Python is an open source language with an extremely readable syntax and therefore it is very easy to develop programs quickly for scientific and engineering research.

#### 6. DURATION

Total Duration: 30 Hrs. [Contact Class. 13 Hrs. Lab Hours 7 Hrs, Course Works: 6 Hrs and Assessment Works: 4 Hrs]



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## 7. CURRICULUM FOCUS

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

## 8. COURSE OBJECTIVES

- (a) Understand the basic techniques of numerical analysis.
- (b) Understand and apply computational techniques to basic problems in Physics.

## 9. SKILL EXPECTED

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

- (a) Solve physics problems using techniques of numerical analysis.
- (b) Use Python Language in solving Basic physics problems.

## 10. COURSE OUTCOMES

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

CO No	Course Outcome(CO)	Skill/Knowledge Attainment Level Based on Revised Bloom's Taxonomy
CO1	Understand the Basics of Python programming	Understand
CO2	Understand the applications of Python modules	Understand
CO3	Understand the basic techniques of numerical analysis	Understand
CO4	Understand and apply computational	Understand & Apply



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CO No	Course Outcome(CO)	Skill/Knowledge Attainment Level Based on Revised Bloom's Taxonomy
	techniques to physical problems	

## 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
CO1	3	3	3	3	2	2	1	1	1	2	1	2	3	3	3	3
CO2	3	3	3	3	2	2	1	1	1	2	1	2	3	3	3	3
CO3	3	3	3	3	2	2	1	1	1	2	1	2	3	3	3	3
CO4	3	3	3	3	2	2	1	1	1	2	1	2	3	3	3	3
AVG	3	3	3	3	2	2	1	1	1	2	1	2	3	3	3	3

## 12. MODULE-WISE COURSE CONTENTS

### MODULE 1: INTRODUCTION TO PYTHON PROGRAMMING

**MODULE DURATION:** 8 Hrs. [Contact Hrs. 4 Hrs. Lab Hours: 2 Hrs. Course Woks: 1 and Assessment Works: 1]

**MODULE CONTENT:** Introduction to Python language, Advantages of Python in comparison with other Language, Different methods of using python: Using python as a calculator, Writing python programs and execution, Input and Output Statement, Variables, Operators, expressions and statements, Lists, List functions, Conditionals, Iteration and looping, Functions.



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**MODULE OUTCOME:** On successful completion of the module learners can familiarize with the basics of the Python Language.

#### MODULE 2: NUMERICAL METHODS IN PHYSICS

**MODULE DURATION:** 12 Hrs. [Contact Hrs. 5 Hrs. Lab Hours: 3 Hrs. Course Woks: 3 and Assessment Works: 1]

**MODULE CONTENT:** General introduction to numerical methods, Curve Fitting: Principle, Solution of algebraic equations: Newton-Raphson method, Numerical differentiation and integration, Difference table, Trapezoidal and Simpson's method, Taylor's Series : Sin(x) and Cos(x).

**MODULE OUTCOME:** On successful completion of the module, learners will be able to understand the numerical techniques commonly used in physics.

#### MODULE 3: COMPUTATIONAL PHYSICS

**MODULE DURATION:** 10 Hrs. [Contact Hrs. 4 Hrs. Lab Hours: 2 Hrs. Course Woks: 2 and Assessment Works: 2]

**MODULE CONTENT:** One Dimensional Motion-Falling Objects, Formulation from Analytical methods to Numerical Methods - Euler Method, Freely falling body, Fall of a body in viscous medium, Simulation of free fall and numerical integration.

**MODULE OUTCOME:** On successful completion of the module learners will be able to solve problems in physics using computational techniques.

#### REFERENCES

1. Beazley, D. M. (2009). *Python Essential Reference*. Addison-Wesley Professional.



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2. Chun, W. (2001). *Core Python Programming* (Vol. 1). Prentice Hall Professional.
3. Sastry, S. S. (2012). *Introductory Methods Of Numerical Analysis*. PHI Learning Pvt. Ltd.

### ADDITIONAL REFERENCES & STUDY MATERIALS:

4. Van Rossum, G., & Drake, F. L. (2002). *Python Tutorial*, Release 2.2.1.

## 13. DELIVERY MODE

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

## 14. DELIVERY SCHEDULE

November to February.

## 15. DETAILED COURSE DELIVERY PLAN

Hour	Delivery Mode and Activity	Topics to be Covered
1	Contact Hour 1	Introduction to Python language, Advantages of Python in comparison with other Language, Different methods of using python, Writing python programs and execution.
2	Contact Hour 2	Inputs and outputs statement, Variables, Operators and Expressions.
3	Lab Session 1	Installation and running python
4	Contact Hour 3	Lists, List functions.
5	Contact Hour 4	Conditionals, Iteration and looping, Functions.



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Hour	Delivery Mode and Activity	Topics to be Covered
6	Lab Session 2	Familiarization of Lists, List functions, Conditionals, Iteration and looping, Functions.
7	Course Work 1: Course Assignment	Course Assignment to write python program with Specific input and expected output.
8	Contact Hour 5	General introduction to numerical methods. Curve Fitting: Principle.
9	Contact Hour 6	Solution of algebraic equations, Newton-Raphson method.
10	Contact Hour 7	Numerical differentiation and integration, Difference table.
11	Course Work 2: Course Assignment	Course Assignment to write python programme for Curve Fitting.
12	Course Work 3: Course Assignment	Course Assignment to write python programme for Curve Fitting.
13	Lab Session 3	Create and Execute python programme Curve Fitting.
14	Lab Session 4	Create and Execute python programme for Newton-Raphson method.
15	Contact Hour 8	Trapezoidal and Simpson's (1/3) method.
16	Contact Hour 9	Taylor's Series : Sin(x) and Cos(x)
17	Course Work 4: Course Assignment	Course Assignment to Write python programme for Trapezoidal method, Simpson's method, Taylor's Series
18	Lab Session 5	Create and Execute python programme for Trapezoidal method, Simpson's method, Taylor's Series



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Hour	Delivery Mode and Activity	Topics to be Covered
19	Assessment Hour	First internal examination
20	Assessment Hour	First internal examination
21	Contact Hour 10	One Dimensional Motion: Falling Objects
22	Contact Hour 11	Formulation: from Analytical methods to Numerical Methods Euler Method Freely falling body.
23	Course Work 5: Course Assignment	Course Assignment to Write python programme for Freely falling body
24	Contact Hour 12	Fall of a body in viscous medium.
25	Contact Hour 13	Simulation of free fall and numerical integration
26	Course Work 6: Course Assignment	Course Assignment to Write python programme for Fall of a body in viscous medium and displacement of a free falling body by numerical integration
27	Lab Session 6	Create and Execute python programme for Fall of a body in viscous medium
28	Lab Session 7	Create and Execute python programme for displacement of a free falling body by numerical integration
29	Assessment Hour	Second internal examination
30	Assessment Hour	Second internal examination

## 16. ASSESSMENT COMPONENTS

Total Marks: 100



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Principal: 0495-2295121

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



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# MUHAMMED ABDURAHIMAN MEMORIAL ORPHANAGE (MAMO) COLLEGE

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## DEPARTMENT OF PHYSICS

### CURRICULUM FOR CERTIFICATE COURSE - CERPH003

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

**MID-COURSE ASSIGNMENT: 30 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



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### DEPARTMENT OF PHYSICS

### CURRICULUM FOR CERTIFICATE COURSE - CERPH003

Percentage of Mark	Letter Grade	Interpretation	Class
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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