

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

CERPHO05: PHYSICS OF BIOMEDICAL INSTRUMENTS

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



MANASSERY, MUKKAM POST, KOZHIKODE, KERALA, INDIA, 673 602. EMAIL: MAMOCOLLEGE@GMAIL.COM



OFFICE: 0495-2297319 PRINCIPAL: 0495-2295121



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DEPARTMENT OF PHYSICS

CURRICULUM FOR CERTIFICATE COURSE - CERPH005

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INSTITUTIONAL **MISSION OBJECTIVES**



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



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: 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



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: 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.



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]

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.



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]

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]**

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.



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.



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

CERPH005: PHYSICS OF BIOMEDICAL INSTRUMENTS

COURSE CURRICULUM

Course Name	Physics of Biomedical Instruments
Course Code	CERPH005
Year	2018-19
Course Designer	Dr. Saheer Cheemadan
Couse 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

None.

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

Dr. Shaheer Cheemada, Assistant Professor, Department of Physics.

5. COURSE PREAMBLE

At present all are suffering from many diseases of the nears and dears. Many are so feared about the outcomes and results of modern analysing technologies like EEG, ECG, EOG, CT, MRI, etc. this course intend to inculcate the basic idea of these widely used techniques into the learners and also to remove the fear about the long procedure done in the medical field. To enable learners to work in multidisciplinary environment involving physics and healthcare by acquiring basic knowledge in Physics, biology & mathematics.

6. DURATION

Total Duration: 30 Hrs. [Contact Hrs. 20 Hrs., Course Works: 4 and

Assessment Works: 6]



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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

- (a) Theoretical knowledge on modern technologies implemented
- (b) Acquire ability to analyse real life problems and decide technically sound, economical and socially acceptable healthcare solution

9. SKILL EXPECTED

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

- (a) Approach diseases from multiple perspectives
- (b) Understand and suggest current healthcare necessities and associated multidisciplinary environment

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	Describe, compare, contrast, demonstrate, explain the basics of ultrasonic canning and x ray imaging	Understand			



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CO No	Course Outcome(CO)	Skill/Knowledge Attainment Level Based on Revised Bloom's Taxonomy
CO2	NMR studies, applications on various diseases	Understand
CO3	Analyse various imaging techniques	Analyse
CO4	Prepare first information reports if required	Evaluate

11. MAPPING OF COs WITH PSOs AND POs

COs	PO1	P02	P03	P04	PO5	P06	PO7	P08	P09	PO10	P011	PO12	PS01	PS02	PSO3	PS04
CO1	2	1	1	2	1	1	2	1	1	1	1	1	1	3	2	2
CO2	2	2	3	2	1	1	2	1	1	1	1	1	2	2	3	2
CO3	2	3	3	2	1	1	2	1	1	1	2	1	2	2	3	3
CO4	2	2	2	3	1	1	2	1	1	1	2	1	2	2	3	2
AVG	2	2	2.2	2.2	1	1	2	1	1	1	1.5	1	1.5	2.5	2.5	2.5

12. MODULE-WISE COURSE CONTENTS

MODULE 1: ULTRASOUND SCANNING AND X RAY IMAGING

MODULE DURATION: 10 Hrs. [Contact Hrs. 7, Course Works: 1 and

Assessment Works: 2]

MODULE CONTENT: Ultrasonic Imaging-properties of ultrasound, modes of ultrasound transmission-pulsed, continuous, pulsed Doppler, ultrasonic diagnosis, ultrasonic transducers., X-rays- Instrumentation for diagnostic X-



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rays, visualization of X-rays-fluoroscopy, X-ray filters, X-ray films, Image intensifiers, , Angiography

MODULE OUTCOME: On successful completion of the module learners can familiarize with the fundamentals of the safety procedures and process of ultrasonic scanning and x ray imaging

MODULE 2: APPLICATION OF NMR

MODULE DURATION: 12 Hrs. [Contact Hrs. 8, Course Works: 2 and

Assessment Works: 2]

MODULE CONTENT: Nuclear Medical imaging systems-radio isotopes in medical imaging systems, physics of radioactivity, uptake monitoring equipment, radioisotope rectilinear scanner, gamma camera, Emission computed tomography, Positron emission tomography (PET Scanner) Principles of NMR, Image reconstruction techniques, Basic NMR components, Biological effects of NMR imaging, advantages of NMR imaging

MODULE OUTCOME: On successful completion of the module learners will be able to know more about NMR and its fields of applications

MODULE 3: LASERS AND MEDICAL FIELD

MODULE DURATION: 8 Hrs. [Contact Hrs. 5, Course Works: 1 and Assessment Works: 2]

MODULE CONTENT: Special properties of laser beam (coherence, collimation, monochromaticity), laser active medium, focal length of the laser lens, Lasertissue interactions, Basic principles of Nd-YAG, CO₂, and Argon Lasers, An overview of their clinical applications with special reference to Gynaecology, pulmonary, neurosurgery, dermatology, ophthalmology. Photodynamic therapy, Laser safety measures.

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MODULE OUTCOME: On successful completion of the module learners will be able to know more about NMR and its fields of applications

REFERENCES

- 1. R S Khandpur, Handbook of Biomedical Instrumentation, Tata Mcgraw Hill
- 2. Leslie Cromwell, *Biomedical Instrumentation and Measurement*, Prentice Hall of India
- 3. Gregory Absten, Lasers in Medicine An Introductory Guide, Springer Science Publications.

ADDITIONAL REFERENCES & STUDY MATERIALS:

4. F Duck, *Ultra sound in Medicine*, IOP Publications

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 Lecture 1	Ultrasonic Imaging-properties of ultrasound
2	Contact Lecture 2	modes of ultrasound transmission- pulsed, continuous, pulsed Doppler,



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Hour	Delivery Mode and Activity	Topics to be Covered
		ultrasonic diagnosis, ultrasonic
		transducers
3	Contact Lecture 3	X-rays- Instrumentation for
Ü	Contact Ecotary 5	diagnostic X-rays
4	Contact Lecture 4	visualization of X-rays-fluoroscopy
5	Contact Lecture 5	X-ray filters
6	Contact Lecture 6	X-ray films
7	Contact Lecture 7	Image intensifiers, , Angiography
8	Course work 1	Discussion – Module 1
9	Assessment 1	Assignment – Module 1
10	Assessment 2	Multiple choice exam – Module 1
11	Contact Lecture 8	Nuclear Medical imaging systems
12	Contact Lecture 9	radio isotopes in medical imaging
14	Contact Lecture 3	systems
13	Contact Lecture 10	physics of radioactivity
14	Contact Lecture 11	uptake monitoring equipment,
11		radioisotope rectilinear scanner
15	Contact Lecture 12	gamma camera, Emission computed
10	2011000 200012 12	tomography
16	Contact Lecture 13	Positron emission tomography (PET
		Scanner)
17	Contact Lecture 14	Principles of NMR, Image
		reconstruction techniques,
18	Contact Lecture 15	Basic NMR components, Biological effects of NMR imaging, advantages
18	Contact Lecture 15	of NMR imaging
19	Course work 2	Review on the lectures 8-11
	Course work 3	Review on the lectures 11-15
20	Course work 5	neview on the lectures 11-15



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Hour	Delivery Mode and Activity	Topics to be Covered			
21	Assessment 3	Problem solving on the basics radioactivity			
22	Assessment 4	Multiple choice/ descriptive exam Module 2			
23	Contact Lecture 16	Special properties of laser beam (coherence, collimation, monochromaticity), laser active medium, focal length of the laser lens			
24	Contact Lecture 17	Laser-tissue interactions			
25	Contact Lecture 18	Basic principles of Nd-YAG, CO ₂ , and Argon Lasers			
26	Contact Lecture 19	An overview of their clinical applications with special reference to Gynaecology, pulmonary, neurosurgery, dermatology, ophthalmology. Photodynamic therapy			
27	Contact Lecture 20	Laser safety measures			
28	Course work 4	Discussion on Lasers			
29	Assessment 5	Assignment on Lasers			
30	Assessment 6	Multiple choice/ descriptive exam			

16. ASSESSMENT COMPONENTS

Total Marks: 100



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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:

Percentage of Mark	Letter Grade	Interpretation	Class
95 and above	0	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	В	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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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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