



PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM – 636011

**DEGREE OF MASTER OF PHILOSOPHY
CHOICE BASED CREDIT SYSTEM**

**SYLLABUS FOR
M. PHIL. PHYSICS
(SEMESTER PATTERN)**

**(For Candidates admitted in the Colleges affiliated to
Periyar University from 2017-2018 onwards)**

REGULATIONS

FULL – TIME

1. ELIGIBILITY

Candidates who have qualified for post graduate degree of this University or any other University recognized by the Syndicate as equivalent thereto shall be eligible to register for the Degree of Master of Philosophy (M.Phil.) in their respective subject and undergo the prescribed course of study in an approved institution or department of this University.

Candidates who have qualified their post graduate degree on or after 1st January 1991 shall be required to have obtained a minimum of 55 % of marks in their respective postgraduate degree to become eligible to register for the Degree of Master of Philosophy (M.Phil.) and undergo the prescribed course of study in an approved institution or department of this University.

In the case of teachers (or) others registering for part-time registration, the minimum percentage of marks for registration is 50 %.

For the candidates belonging to SC/ST community and those who have qualified for the Master's degree before 01.01.1991 the minimum eligibility marks shall be 50 % in their Master's Degree.

2. DURATION

The duration of M.Phil., course shall extend over a period of one year from the commencement of the course.

3. COURSE OF STUDY

The course of study for M.Phil., degree shall consist of (a) Part-I comprising three written papers according to the Syllabus prescribed from time to time; and (b) Part-II Dissertation.

Part-I shall consist of Paper-I Research Methodology and Paper-II Advanced paper in the main subject. There shall also be a third paper which shall be the background paper relating to the proposed Dissertation conducted internally by the College/Departments.

COURSE OF STUDY AND SCHEME OF EXAMINATION

Part	Title of the Paper	Credits	Internal	External	Total Marks
I	Paper I Scientific Research and Methodology	6	25	75	100
II	Paper II Advanced Physics	6	25	75	100
III	Paper III Guide Paper	6	25	75	100
IV	Dissertation and Viva- Voce	12	-	150 50	200
	TOTAL	30			500

5. SCHEME OF EXAMINATIONS

Part I – Written Examination

The written examination of papers I, II and III shall be held at the end of the year. The duration for each paper shall be 3 hours carrying a maximum of 75 marks.

Paper III written examination will be conducted by the College/Departments and the marks obtained by the candidate along with the question paper and valued answer scripts shall be sent to the University 15 days before the commencement of the examinations of paper I and II.

The examiners will be appointed from the panel of four names of each paper (I and II) submitted by the College / Departments concerned. If one examiner awards a pass mark and the other fail mark then the paper will be valued by a third examiner whose award of marks will be final.

Part II – Dissertation

The exact title of the Dissertation shall be intimated within one month after the completion of the written examination. Candidates shall submit the Dissertation to the University through the Supervisor and Head of the Department at the end of the year from the commencement of the course which shall be valued by internal examiner (supervisor) and one external examiner appointed by the University from a panel of four names sent by the Supervisor through the Head of the Department / Principal at the time of submitting the dissertation.

The examiners who value the Dissertation shall report on the merit of candidates as “Highly Commended” (75 % and above) or “Commended” (50 % and above and below 75 %) or “Not Commended” (below 50 %).

If one examiner commends the Dissertation and the other examiner, does not commend, the Dissertation will be referred to a third examiner and the third valuation shall be final.

Submission or resubmission of the Dissertation will be allowed twice a year.

6 QUESTION PAPER PATTERN

Question paper pattern for Part-I Examinations:

Time - 3 Hours

Maximum - 75 Marks

Section – A : 5 x 5=25 Marks

(Answer all questions, Either or Type)

Section – B : 5x10=50 Marks

(Answer all questions, Either or Type)

Internal Marks: The internal marks will be awarded based on the following components.

Test : 10 Marks

Term Paper : 5 Marks

Seminar : 5 Marks

Attendance : 5 Marks

25 Marks

7. PASSING MINIMUM

A candidate shall be declared to have passed Part - I of the examination if he/she secured not less than 50 % of the marks in each paper including Paper III for which examination is conducted internally.

A candidate shall be declared to have passed Part – II of the examination if his / her dissertation is commended.

All other candidates shall be declared to have failed in the examination.

8. RESTRICTION IN NUMBER OF CHANCES

No candidate shall be permitted to reappear for the written examination in any paper on more than two occasions or to resubmit a Dissertation more than once. Candidates shall have to qualify for the degree passing all the written papers and dissertation within a period of three years from the date of commencement of the course.

9. CONFERMENT OF THE DEGREE

Candidates shall be eligible for the conferment of the M.Phil. Degree only after he/she is declared to have passed both the parts of the examinations as per the Regulations.

10. QUALIFICATIONS FOR RESEARCH GUIDE

Every candidate admitted into the M.Phil. degree shall be registered under a qualified and recognized guide in affiliated colleges / departments. The research guide shall guide the candidate throughout the research programme.

No teacher shall be recognized as a Supervisor unless he possesses Ph.D. degree or two years of PG teaching experience after qualifying for M.Phil. or M.Litt. Degree.

Only the postgraduate departments of affiliated colleges and departments of the University will be recognized for guiding the M.Phil. course, provided however, the Syndicate shall have the power to decide any other institutions of higher learning/ research within the University area for conducting the M.Phil. course on merits.

REGULATIONS

PART – TIME

1. ELIGIBILITY

- i. Teacher candidates working in the affiliated colleges and whose qualifications are approved by the University.
- ii. Teacher candidates working in Polytechnics approved by the Director of Technical Education or in Higher Secondary Schools and High Schools approved by State Board or Central Board of Secondary Education or Educational Institutions of IAF (within Periyar University area) who possess a Master's Degree. For the Master's Degree qualified prior to 01.01.1991, no minimum marks is prescribed; but on or after 01.01.1991, a minimum of 55 % of the marks is prescribed, provided that for the candidates belonging to SC/ST community a concession of 5 % marks will be given in the minimum eligibility marks prescribed.

2. DURATION

The course of study shall extend over a period of two years from the commencement of the course. The examinations for Part-I shall be taken at the end of the first year and Part-II Dissertation at the end of the second year.

3. REGULATION

The Regulation governing the full-time M.Phil. course with regard to course of study, scheme of examinations, passing minimum and qualifications of research guide for conducting the M.Phil. course shall apply to part-time candidates also.

4. RESTRICTION IN NUMBER OF CHANCES

No candidate shall be permitted to reappear for the written examination in any paper on more than two occasions or to resubmit a Dissertation more than once. Candidates shall have to qualify for the degree passing all the written papers and dissertation within a period of four years from the date of commencement of the course.

M.Phil. PHYSICS

PART I

PAPER I - SCIENTIFIC RESEARCH AND METHODOLOGY

UNIT I Method of Research

Objectives and motivation in research – types of research – research and scientific method – research problem – selecting the problem – techniques involved in defining the problem – research design – literature survey – data collection – the use of computers in research – access using internet web tools – e-mails – e-journals – uses of research engines – impact and usefulness of the research problem.

UNIT II Research Process

Criteria of good research – processing of data – interpretation of data – significance of report writing – different steps in writing research report – research presentation–multimedia techniques in paper presentation – power point and poster presentation–synopsis writing – art of writing a research paper – dissertation and thesis.

UNIT III Numerical Methods

System of linear equations – Gauss-Jordan elimination method – iterative method – Newton – Raphson method – Numerical integration – Simpson's 1/3 rule – Simpson's 1/8 rule – Gauss – Legendre quadrature – Solution of differential equations – Runge-Kutta Method – Eigen values and Eigen vectors – Power method – Jacobi's method.

UNIT IV Statistical Methods

Interpolation – significance of interpolation – methods of interpolation – Binomial method – Newton's method – Newton's forward form – Newton's backward form – Finite differences – Lagrange's method – theoretical distribution – Binomial – Poisson – hypergeometric and normal distributions – data fitting-principle of least squares – fitting a straight line – curve fitting – Chi square test – conditions for applying Chi square test – uses and limitations.

UNIT V Programming in C

Introduction – constants, variables and data types – operations and expressions – arrays – one dimensional and two dimensional arrays – declaring and initializing string variables – user defined functions – pointers – file handling – defining and opening a file – closing a file – input/output operations in files – error handling – random access – command line – the processor – macro substitution – file inclusion – compiler control directive – Sample programs: Matrix multiplication, Diagonalization and inversion – solution to simultaneous equation – differential equations.

REFERENCE BOOKS:

1. Multimedia Communications – Directions and Innovation – Jerry D.Gibson – Academic Press – Harcourt Asia Company (2000).
2. Multimedia Systems – John F. Koegel Buford – Twelfth Edition – Pearson Education (2005).
3. Thesis and assignment writing – J.Anderson, B.H.Durston and M.Poole – Wiley Eastern, New Delhi (1977).
4. How to write a research paper – Ralph Berry, Pergamon Press, Oxford (1986).
5. Form and style in thesis writing – W.G.Campbell, The University of Chicago Press (2016).
6. A Handbook of Methodology of Research – Rajammal P.A.Devadas, R.M.M.Vidyalaya Press (1976).
7. Computer Oriented Numerical Methods- V.Rajaraman, Prentice Hall (1985).
8. Programming in C – E.Balagurusamy - Tata Mc Graw Hill Publishing Company Limited, New Delhi (2008).
9. Programming with C - Schaum's outline series - Tata Mc Graw Hill Publishing Company Limited, New Delhi (2004).
10. An Introduction to Numerical Analysis – Devi Prasad – Narosa Publishing house Pvt. Ltd., New Delhi (2010).
11. Numerical methods for scientific and Engineering Computation – N.K.Jain, S.R.K.Iyengar and R.K.Jain – New Age International Publisher (2004).
12. Numerical methods – E.Balagurusamy – Tata Mc Graw – Hill Education, New Delhi (1999).
13. C.R.Kothari – Research Methodology: Methods and Techniques – New age international Publishers, New Delhi (2010).

M.Phil. PHYSICS
PART - I
PAPER-II- ADVANCED PHYSICS

UNIT I : Energy Sources

Energy sources and their availability – renewable energy sources - prospects of renewable energy sources - Solar cells for direct conversion of solar energy to electric power – Solar cell parameters – Solar cell electrical characteristics – Efficiency – Single crystal silicon solar cells – Polycrystalline silicon solar cells – cadmium sulfide solar cells - Applications of solar energy: Solar water heating – space heating and space cooling – solar photo voltaics – agricultural and industrial process heat – solar distillation – solar pumping – solar furnace – solar cooking – solar green house – Wind energy - basic principles- wind power - generation- storage - applications.

UNIT II : X-ray Diffraction

Crystal structure-lattice planes - Miller indices – space lattice – reciprocal lattice – relation between direct and reciprocal space – Bragg's law in reciprocal lattice – X-ray Powder diffraction method – principle of Powder diffraction-methods of Powder diffraction pattern – interpretation of powder photographs – methods of recording X-ray diffraction – X-ray diffractometer – X-ray sources – rotating anode generators – goniometer – video camera – X-ray detector system – data collection - determination of structure factor – amplitude from intensities – steps in crystal structure determination – crystallization – crystal mounting – data reduction – determination of thermal and scale factors – space group determination – structure solution – structure refinement- structural analysis.

UNIT III : Lasers and Non Linear Optics

Lasers: Basic principles of Lasers – Nd:YAG Laser – He-Ne Laser – Semiconductor diode Laser – Dye Laser – Co-Chemical Laser – Tunable Laser – Colour center Lasers – Applications of Laser in medicine – industry – communication and Holography.

Non Linear Optics: Theory of non linear optical effect – non linear optical process – Harmonic generation – second and third harmonic generation – phase matching – optical mixing – optical parametric oscillation – multi-photon processing – non linear optics at an interface – Applications of non linear optical materials – various non linear optical parameters – Non linear optical materials: Crystals, inorganic, organic and semi – organic crystals.

UNIT IV : Vibrational Spectroscopy

Infrared Spectroscopy – vibrational study of diatomic molecules – IR rotation – vibrational spectra of gaseous diatomic molecules – simple gaseous polyatomic molecules – vibrational frequencies and qualitative analysis – quantitative IR analysis – determination of bond length and bond moment – determination of interstellar atoms and molecules. Application of spectroscopic techniques to structural elucidations: Fourier Transform Infrared and Raman, ^1H and ^{13}C Nuclear Magnetic resonance, ultraviolet and visible and fluorescence spectroscopy.

UNIT V : Crystal Growth and Thin Film Physics

Nucleation – spherical and cylindrical nucleation – solution growth methods: slow cooling – slow evaporation and temperature gradient methods – Melt growth: Bridgman method – Czochralski method - Thin film preparation: Physical methods – thermal evaporation – electron beam evaporation – sputtering method – Chemical methods: chemical bath deposition – spray pyrolysis – thermal characterization techniques – Differential Thermal Analysis – Differential Scanning Calorimetry – Thermal Gravimetric Analysis – Microscopic characterization techniques – Scanning Electron Microscopy – Transmission Electron Microscopy – Scanning tunneling Microscopy – Atomic Force Microscopy.

REFERENCE BOOKS:

1. Principles of Solar Engineering – F.Kreith and J.F. Kreider – Tata McGraw Hill (1978).
2. Applied Solar Energy – A.B.Meinel and A.P.Meinel – Addison Wesley Publishing Co.,(1976).
3. Solar Energy – M.P.Agarwal – S.Chand and Co., New Delhi (1983).
4. Solar Energy – S.P.Sukhatme – Tata McGraw Hill (1997).
5. Non Conventional Energy Sources – G.D.Rai – Khauna Publishers, New Delhi (2009).
6. X-ray Structure Determination – Second Edition – Stout and Jensen – John Wiley Publications (1989).
7. Fundamentals of Crystallography – Third Edition – C. Giacovazzo - Oxford University Press (2011).
8. Structure Determination by X-ray Crystallography - Second Edition - M.F.C. Ladd and R.A.Palmer-Plenum Press, New York (1986).
9. Elementary Crystallography - D.Velmurugan-MJP Publishers, Chennai (2008).
10. Laser Fundamentals - William Silfvast - Cambridge University Press, London (1996).
11. Lasers and Non-linear Optics - Second Edition- B.B.Laud – New Age International Publishers, New Delhi (1991).
12. Laser Spectroscopy: Basic concepts and Instrumentation – Third Edition– Demtroder and Wolfgang – Springer – International Edition (2003).
13. Optics – Second Edition – Ajoy Ghatak – Tata Mc Graw Hill (2013).
14. Fundamentals of Molecular Spectroscopy – C.N.Banwell – Tata McGraw Hill (1972).
15. Spectroscopy Vol.2 – B.P.Straughan and S.Walkar – Chapman and Hall (1976).
16. Vibrational Spectroscopy – D.N.Sathyanarayana – New Age International Publishers (2007).
17. Crystal Growth Process – J.C.Brice – John Wiley and Sons, New York (1986).
18. Crystal Growth Processes and methods – P.Santhana Ragavan and P.Ramasamy – KRU Publications, Kumbakonam (2001).
19. Thin Film Fundamentals – A.Goswami – New Age International, New Delhi (1996).

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PAPER III : GUIDE PAPER

OPTIONAL :

- (a) Material Science
- (b) Crystallography and Molecular Biophysics
- (c) Crystal Physics
- (d) Laser Physics
- (e) Spectroscopy
- (f) Non Linear Optics
- (g) Thin Film Physics
- (h) Energy Physics
- (i) Nano Physics

Model Question Papers

PAPER I : SCIENTIFIC RESEARCH AND METHODOLOGY

Time: 3 Hours

Max. Marks:75 marks

SECTION – A (5x5=25)

Answer ALL questions

1. (a). Discuss briefly about synopsis writing. (Or)
(b). Briefly discuss the multimedia techniques in paper presentations.
2. (a). Describe the Jacobian method for matrix diagonalisation. (Or)
(b). State the formula and explain procedure for Runge Kutta method of fourth order.
3. (a). Explain briefly about Lagrangian interpolation formula. (Or)
(b). Find the best fit values of 'a' and 'b' so that $y=ax+b$ fits the data given below.

X	0	1	2	3	4
Y	1	1.8	3.3	4.5	6.3

4. (a). Differentiate between the constants and variables in C programming with suitable examples. (Or)
(b). Write a simple program using logical operator.
5. (a). Describe string declaration and initialization with suitable example. (Or)
(b). Write briefly about functions in C programming.

SECTION – B (5x10=50)

Answer ALL questions

6. (a). Explain the various steps involved in presenting a scientific seminar. (Or)
(b). Explain in detail the steps involved in research methodology.
7. (a). Using Simpson's one third rule evaluate $\int_1^2 x \ln x \, dx$ taking 4 interval. Compare the results with actual integral value. (Or)

X	0	0.25	0.5	0.75	1
Y = x ln x	0	0.321	0.824	1.588	2.71

- (b). State the procedure of Gauss – Jordan method and solve the following equations by the same method.

$$10x + y + z = 12; \quad 2x + 10y + z = 13; \quad x + y + 5z = 7$$

8. (a). Using Newton's forward interpolation formula, find the polynomial satisfying the following data. Hence evaluate y at $x = 0.7$ (Or)

X	4	6	8	10
Y	1	3	8	10

- (b). Fit a second degree parabola to the following data taking 'x' as the independent variable.
9. (a). Discuss in detail the different operators in C programming. (Or)
(b). Brief the following with examples.
- Basic structure of a C program
 - Declaration of variables
 - Assigning values to the variable.
10. (a). What is an array? Explain in detail about declaring the initializing of two dimensional arrays with suitable example. (Or)
(b). Write a C – program for solving the following simultaneous equations $ax + by = c$ and $px + qy = r$.

Model Question Papers
PAPER II : ADVANCED PHYSICS

Time: 3 Hours

Maximum :75 Marks

SECTION – A (5x5=25)

Answer ALL questions

1. (a). Write about the prospects of renewable energy sources. (Or)
(b). Describe the principle of working of solar furnace.
2. (a). What are Miller indices? Explain the uses. (Or)
(b). Write a note on X- ray sources.
3. (a). Give the basic principle of Lasers. (Or)
(b). Write short notes on optical mixing.
4. (a). How would you determine the bond length of diatomic molecule. (Or)
(b). Explain the significance of fluorescence spectroscopy.
5. (a). Describe the phenomenon of nucleation in crystal growth. (Or)
(b). Explain the reactive sputtering method in thin film preparation.

SECTION – B (5x10=50)

Answer ALL questions

6. (a). Explain the photovoltaic principle. Discuss a basic photovoltaic system for power generation. (Or)
(b). Write a note on:
 - (i). Solar Pumping
 - (ii). Solar Cooking.
7. (a). Discuss a rotating anode X- ray generator. (Or)
(b). Describe the X-ray powder diffraction method.
8. (a). Explain:
 - (i). He – Ne laser
 - (ii). Nd:YAG laser.
(b). Discuss second and higher order harmonic generations.
9. (a) Discuss the vibration spectra of a polyatomic molecule. Obtain the energy levels. (Or)
(b). Explain how NMR finds applications in the structural determination. Illustrate your answer with specific examples.
10. (a). Describe in detail the Czochralski method to grow single crystal with a neat diagram. (Or)
(b). Explain the preparation of thin films by chemical bath deposition method.