

PERIYAR EVR COLLEGE (AUTONOMOUS)

TIRUCHIRAPPALLI – 620 023

PG AND RESEARCH DEPARTMENT OF PHYSICS



REVISED SYLLABUS FOR M.Phil., PHYSICS

(FOR STUDENTS ADMITTED FROM 2018 ONWARDS)

PERIYAR EVR COLLEGE (AUTONOMOUS & REACCREDITED)
TIRUCHIRAPPALLI – 620 023
PG AND RESEARCH DEPARTMENT OF PHYSICS

M.Phil. PHYSICS (2018 - 19 ONWARDS)

COURSE PATTERN

SEMESTER I										
S. No	Course	Course Title	Exam Hrs.	Hrs.	Credits	Internal Exam	External Exam	Total		
01	CC I	Core I: RESEARCH METHODOLOGY	3	6	4	40	60	100		
02	CC II	Core II: ADVANCED TOPICS IN PHYSICS	3	6	4	40	60	100		
03	CC III	Core III: MATERIAL SCIENCES	3	6	4	40	60	100		
04	CC IV	Core IV: TEACHING AND LEARNING SKILLS	3	6	4	40	60	100		
TOTAL						16	160	240	400	
SEMESTER II										
05	VIVA-VOCE	PROJECT DISSERTATION	-	-	8	200		200		
TOTAL					-	-	24	160	240	600

1. Dissertation and Viva – Voce – 200

Dissertation	150 Marks	}	
Viva – Voce	50 Marks		
			200

2. Continuous Internal Assessment (CIA) – 40

Test (2 x 10)	20 Marks	}	
Assignment	10 Marks		
Seminar	10 Marks		
			40

3. University Examination

60 Marks	60	}	
			100

QUESTION PAPER STRUCTURE FOR M.Phil

5 out of 8 questions

$5 \times 12 = 60$

Total marks

60

Passing Minimum:

40% of marks in the University examination

50% of marks in the aggregate (CIA+ Written Examination)

RESEARCH METHODOLOGY

Unit – I: Working on a Research Problem

Scientific research – Research approaches and Significance of Research – Identification of research problem: Determining the mode of attack – Current status – Literature survey – Abstraction of a research paper – Access using Internet web tools – e-mail – Impact and usefulness of the research problem – Role of research guide – Guidance and rapport – Preparation and presentation of Scientific reports; need and methods – Writing of synopsis and dissertation and thesis.

Unit – II: Techniques of Scientific Writing

Scientific Writing - definition – organizing a scientific paper – Title – listing of authors and address – abstract – introduction – materials and methods section – results section – discussion section – acknowledgement – references – review process – publishing process – reprints – review paper – conference report – oral and poster presentation – thesis – Preparation for a research projects – Statement of problem – Design of project – budget proposal.

Unit – III: Data Analysis

Introduction – Statistical description of data - Mean, variance, skewness, median, mode – Distributions – Student's t-test, F-test, Chi-square test – Linear and rank correlations – Modeling data: Least-squares, Fitting data. (Theory and elementary Problems).

Unit IV: Numerical Solution of Ordinary Differential Equation

Power Series approximation – Point wise Method – Solution by Taylor Series (Type I) – Taylor series method for first and second order differential equation – Iterative method for Eigen values: Jacobi method for Eigen values - Numerical Methods for double integration: Trapezoidal rule - Simpson's rule.

Unit V: Spectral Analysis

Powder X-ray diffraction – Debye - Scherrer technique – indexing the powder pattern – calculation of particle size using Scherer method – Problems associated with Scherrer method – Weber - Fechner method for particle size analysis - Selected area diffraction – FTIR and Raman Spectroscopy .

Book for Study and Reference:

1. Research Methodology - Methods and Techniques (2nd revised edition), C.R. Kothari
New and International Publishers. (Unit I & IV)
2. Research Methods (Tips and Techniques), G. Vijayalakshmi and C. Sivapragasam,
MJP Publishers. (Unit I)
3. Scientific Thesis Writing and Paper Presentation – N. Gurumani - MJP Publishers.
(Unit II)
4. Instrumental Methods of Analysis (7th Edition), Hobart H. Willard, Lynne L. Merritt, Jr.,
John A. Dean and Frank A. Settle, Jr.
4. Fundamentals of Mathematical Statistics (11th Revised Edition), S.C. Gupta and V.K.
Kapoor – Sultan Chand & Sons. (Unit IV – 2.7 - 2.10, 2.13-2.15, 2.19, 2.32 – 2.33, 2.36 –
2.37, 2.52 – 2.53, 15.2- 15.4, 16.2 -16.3, 16.29 – 16.31).
5. Numerical Methods, P. Kandasamy, K. Thilagavathy and K. Gunavathi – S. Chand &
Company Ltd. (Unit IV & V)
6. Numerical Methods (2nd Edition), S. Arumugam, A. Thangapandi Isaac, A.
Somasundaram – Scitech publication (India) Pvt. Ltd.

ADVANCED TOPICS IN PHYSICS

Unit I: Relativistic Wave Equations

Klein – Gordon Equation – Particle in a Coulomb field – Dirac Equation for a free Particle – Dirac Matrices – Probability density – Plane wave solution – Negative energy state - Chemical Bonding: Molecular orbital method - Molecular orbital treatment of hydrogen molecule.

Unit II: Angular Momentum

The Angular Momentum Operators - Angular Momentum commutation Relations - Eigen values and Eigen functions of L^2 and L_z - General Angular Momentum - Eigen Values of J^2 and J_z – Angular Momentum Matrices – Spin Angular Momentum – Spin vectors for spin-(1/2) System - Addition of angular momenta.

Unit III: Nanotechnology:

Introduction – Preparation of Nano particles: Laser Method – Ball milling method – Carbon Nano tube: Synthesis and purification, Mechanism of Growth, Properties and applications - Nanosensors: Nanoscale organization of sensors – Applications of Nanomaterials (list only).

Unit – IV: Ultrasonic and NDT

Fundamentals of Ultrasonic's – Equation of propagation of Waves – Wave Parameters –Characteristic Properties- ultrasonic interferometry, ultrasonic wave generation methods – Ultrasound blood flow meter – Material Testing: Pulse Echo Method – Flaw detector – Calibration - sensitivity and resolution - material characterization - Applications.

Unit V: Material Characterizations

Single crystal X – ray diffraction - Photo luminescence – Analytical technique – Principles of Scanning electron microscopy, Atomic Force Microscopy (AFM), Transmission electron microscopy (TEM), Energy dispersive X – ray diffraction (EDAX) - Thermogravimetry (TG) – Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry (DSC).

Books for Study and References:

1. Quantum Mechanics (2nd Edition), G. Aruldas – PHI Learning Pvt. Ltd. (Unit I & II)
2. Nano: The Essentials (Understanding Nanoscience and Nanotechnology) – T. Pradeep. Tata McGraw Hill Education Pvt. Ltd. (Unit III)
3. Introduction to Nanotechnology, Charles P. Poole, Jr. and Frank J. Owens – Wiley India Publication. (Unit III).
4. Science and Technology of Ultrasonics, P. Baldev Raj, V. Rajendran and P. Palanisamy - Narosa Publishing House. (Unit IV).
5. Ultrasonic testing Materials, Kraut kramer. (Unit IV)
6. Fundamentals of Molecular Spectroscopy (5th Edition), Colin N Banwell and Elaine M McCash – McGraw Hill Education (India) Pvt. Ltd.
7. Instrumental Methods of Analysis (7th Edition), Hobart H. Willard, Lynne L. Merritt, Jr., John A. Dean and Frank A. Settle, Jr.

MATERIAL SCIENCE

Unit – I: Interatomic force, Bonding in solids and Imperfections in Crystals:

Introduction- Force between atom – Cohesion of atom and cohesive energy – Bonding in Solids: Ionic bond – Bond. energy of NaCl molecule – The Born Haber cycle – Covalent Bond Metallic Bond – Intermolecular Bond – Dispersion Bond – Dipole Bond – Hydrogen Bond -Imperfections in Crystal: Point defect – Vacancies - Schottky defects – Frenkel defects.

Unit II: Crystal Growth and Nonlinear Optics

Nucleation – Theories - Spherical and cylindrical nucleation - Nonlinear optics- basic concepts – First, second and third order harmonic generation- Nonlinear optical (NLO) materials applications - Different growth techniques: Solution growth method - Bridgeman method – Czochralski method- temperature gradient methods – Gel growth - Properties of gel - U- tube and straight tube methods - Flux growth – Principles of flux growth – Choice of flux.

Unit III: Preparation of Thin Films

Chemical methods: Electroplating – Ion plating – Chemical reduction plating – Vacuum evaporation: Evaporation theory – Sputtering methods: - Reactive sputtering – RF sputtering – Preparation of CdSe and PbSe - Properties: Sources of resistivity in metallic conductors - Volt Ampere characteristics (I-V) – Resistivity – Temperature coefficient - Size effects – Band gap studies of semiconducting films.

Unit – IV: Polymer Thin Films

Polymer – Molecular weight and degree of polymerization – Types – Glass transition and Melting point – Amorphous and Crystalline Polymers - Synthesis of conducting polymers and preparation of conducting polymer films - Properties of conducting polymers - Types of electron conducting polymers - Poly Aniline (PANi), Poly Pyrrol (PPy) – Type ion conducting polymers – Poly ethylene oxide (PEO) – Poly vinylidene fluoride (PVdF) – Composite Polymer Electrolytes.

Unit V: Molecular Vibrations

Introduction to normal coordinates – Selection rules for vibrational transition – Vibrational wave functions – Overtone and Combination bands - Identification of Compounds: Group frequencies – Functional group analysis – Factors affecting Group Frequencies - Applications of Raman and IR activities.

Books for Study and References:

1. Solid State Physics (7th Edition), S O Pillai –New Age International Publishers. (Unit I)
2. Crystal Growth Process and Methods, P. Santhanaragavan and P. Ramasamy – KRU Publications (Unit II).
3. Crystal Growth Process, J.C. Brice – John Wiley & Sons. (Unit II)
4. Thin Film Fundamentals, A. Goswami – New Age International Pvt. Ltd. (Unit III)
5. Polymer Science, V R Gowariker, N V Viswanathan and Jeyadev Sreedhar - New Age International Pvt. Ltd. (Unit IV)
6. Vibrational Spectroscopy (Theory and Applications), D.N. Sathyanarayana - New Age International Pvt. Ltd. (Unit V)
7. Fundamentals of Molecular Spectroscopy (5th Edition), Colin N Banwell and Elaine McCash – McGraw Hill Education (India) Pvt. Ltd. (Unit V)

TEACHING AND LEARNING SKILLS

Unit I : Computer Application Skills

Computer System: Characteristics, Parts and their functions – Different generations of Computer – Operation of Computer: switching on / off / restart, Mouse control, Use of key board and some functions of key – Information and Communication Technology (ICT): Definition, Meaning, Features, Trends – Integration of ICT in teaching and learning – ICT applications: Using word processors, spread sheets, Power point slides in the classroom – ICT for Research: On-line journals, e-books, Courseware, Tutorials, Technical reports, Theses and Dissertations.

Unit II – Communication Skills

Communication: Definitions – Elements of Communication: Sender, Message, Channel, Receiver, Feedback and Noise – Types of Communication: Spoken and written; Non-verbal communication – Intrapersonal, Interpersonal, Group and Mass communication – Barriers to communication: Mechanical, Physical, Linguistic & Cultural – Skills of communication: Listening, Speaking, Reading and writing – Methods of developing fluency in oral and written communication – style, Diction and Vocabulary – Classroom communication and dynamics.

Unit III : Communication Technology

Communication Technology: Bases, Trends and Developments – Skills of using Communication Technology – Computer Mediated Teaching: Multimedia, E-content – Satellite-based communication: EDUSAT and ETV channels, Communication through web: Audio and Video applications on the Internet, interpersonal communication through the web.

Unit IV – Pedagogy

Instructional Technology: Definition, Objectives and Types – Difference between Teaching and Instruction – Lecture Technique: Steps, Planning of a Lecture, Delivery of a lecture – Narration in tune with the nature of different disciplines – Lecture with power point presentation – Versatility of lecture technique – Demonstration, Characteristics, Principles, Planning Implementation and Evaluation – Teaching – Learning Techniques: Team Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion – Models of teaching: CAI, CMI and WBI

Unit V – Teaching Skills

Teaching Skill: Definition, Meaning and Nature – Types of Teaching skills: Skill of Set Induction, Skill of Stimulus Variation, Skill of Explaining, Skill of Probing Questions, Skill of Black Board writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills.

Books for Study and References:

1. Bela Rani Sharma (2007), Curriculum Reforms and Teaching Methods, Sarup and sons, New Delhi
2. Don Skinner (2005), Teacher Training, Edinburgh University Press Ltd., Edinburgh
3. Information and Communication Technology in Education: A Curriculum for Schools and programme of Teacher development, Jonathan Anderson and Tom Van Weert, UNESCO, 2002
4. Kumar K.I (2008) Educational Technology, New Age International Publishers, New Delhi
5. Mangal, S.K. (2002) Essential of Teaching – Learning and Information Technology, Tandon Publications, Ludhiana
6. Michael D. and William (2000), Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hall, New York
7. Pandey S.K. (2005) Teaching Communication, Commonwealth Publishers, New Delhi
8. Ram Babu A. and Dandapani S (2006) Microteaching (Vol.1&2) Neelakamal Publications, Hyderabad
9. Singh V.K. and Sudarshan K.N. (1996) Computer Education, Discovery Publishing Company, New York.
10. Sharma R. A. (2006) Fundamentals of Educational Technology, Surya Publications, Meerut
11. Vanaja. M. and Rajasekar S. (2006) Computer Education, Neelkamal Publications, Hyderabad