

M.Phil.(Physics)

Scheme of Examination

	PAPER	MARKS
(1)	Paper I Experimental Techniques	100
(2)	Paper II Theoretical Techniques	100
(3)	Paper III Contemporary Physics	100
(4)	Seminar (two)	100
(5)	Dissertation	100
(6)	Viva-voce	100

	Total	600

PAPER I

Experimental Techniques

Unit 1 Optical Instruments:-

Optical time domain reflectometer, Optical low Coherence reflectometer, Optical Spectrum analyzer, Optical Power and energy meter, Monochromator, CCD, Ellipsometer, Transducers, Lock-in-Amplifier, Box Car Averager

References

1. A.K.Ghatak and K. Thyagrajan, Introduction to fiber optics.
2. B.P.Pal: Fundamentals of Fiber Optics in Telecommunication and Sensor systems, Wiley Eastern Ltd.
3. S.M.Senior: Optical Fiber communication.

Unit II

(a) Nuclear Reaction:-

Basic Features of Nuclear Reactions, Formalism, Discrete Resonance in the Compound Nucleus, Continuum States of the Compound Nucleus, Direct Reaction Mechanism, Nuclear Structure Studies with the One Nucleon Transfer Reactions.

(b) Positron Annihilation Spectroscopy:-

Experimental Technique, Positron Life Time Measurements, Doppler Broadening of Annihilation Radiation, Angular Correlation Measurement.

References

1. Positron Solid State Physics by P. Hautojari
2. Modern Physics in Chemistry by Goldanskii.
3. Introduction to Nuclear Physics Addison Wesley, 1975 by H.A.Engel.
4. Nuclear and Particle Physics by W. E. Burcham and M. Jobs.
5. Concepts of Nuclear Physics by B. L. Cohen.

Unit III Plasma Diagnostic Techniques:-

Single Probe Technique- Measurement of Electron Temperature and Electron Temperature of Plasma, Double Probe Technique - Measurement of Electron Temperature and Density of Plasma.

References

1. Plasma Physics by R. A. Cairns, Blackie USA.
2. Plasma Bhoutiki by S. K. Ghosh.
3. Plasma Physics by S. N. Sen.
4. Plasma Mechanics by Vishwanath Chakroborty.

Unit IV Fiber Optic Components and Devices:-

Direction Couplers, Beam Splitters, Switches Modulations, Connectors, Couplers, Polarizers, Polarization Controllers, Amplifiers, Fiber Lasers, Reflectors, Wavelength Filters, Polarizing Beam Splitters, Wavelength Division Multiplexers, Fiber Optic Isolators.

References

1. A. K. Ghatak and K. Thyagrajan, Introduction to Fiber Optics.
2. B. P. Pal, Fundamentals of Fiber Optics in Telecommunication and Sensor systems Wiley Eastern Ltd.
3. S. M. Senior, Optical Fiber communication.

PAPER II

Theoretical Techniques

Unit I Optical Waveguides:-

Asymmetric Waveguide, Rectangular Waveguides, Channel Waveguides, Strip Loaded Waveguides, Coupled Mode Theory and Coupled Mode Devices.

References

1. P. Bhattacharya, Semiconductor Optoelectronics devices.
2. A. Yariv, Optical Electronics in modern communication, Oxford 1997.

Unit II Plasma Theory:-

- (a) Concept of Plasma, Collective Behavior, Debye Shielding, Plasma Parameters, Fluid Description of Plasma, Fundamental Equations.
- (b) Waves and Oscillation in Plasma, Plasma Oscillations, Electron Plasma Wave, Ion Waves.

References

1. Plasma Physics and Controlled Fusion by F. F. Chen.
2. Plasma Bhoutiki by S. K. Ghosh.
3. Theory of Unmagnetised Plasma by C. Oberai.

Unit III Differential Equation and Integral Functions:-

Solutions of Partial Differential Equation, Laplace's Equation, The Diffusion Equation, Poisson Equation, Gamma Function, The Error Function, Green's Function.

References

1. Mathematics for Physicists by Mary L. Boas.

Unit IV Statistical Data Analysis and Numerical Techniques:-

Sampling, Frequency Distributions (Normal, Log Normal, Poisson); Probability, χ^2 test of Significance, Variance, Mean and Standard Deviation, Time Series, Monte Carlo Methods, Error, Accumulation of Error, Allowable Errors, Curve fitting- Method of fit by least square techniques, Selection of Degree of the Polynomial, Harmonic Analysis, Auto and Cross-Correlation, Fourier Transform and Spectral Analysis, Numerical Integration and Differentiation, Interpolation.

References

1. Numerical Mathematical Analysis, Scarborough Oxford and IBH Publishing.

PAPER III

Contemporary Physics

Unit I Electromagnetic Waves Phenomena in Plasma:-

- (a) Polarization, Phase Velocity, Group Velocity, Electromagnetic Waves Perpendicular to B_0 , Ordinary Waves $E_1 \parallel B_0$
- (b) Extra Ordinary Waves $E_1 \parallel B_0$, their cut offs and Resonance, Electromagnetic waves Parallel to B_0 (i) Magneto Sonic Waves (ii) Alfvén Waves.

Unit II Nonlinear Optics:-

Nonlinear Optical susceptibility, Second & Third Order Optical Susceptibilities, Phase matching, Sum Frequency and harmonic generation, Difference Frequency generation and parametric excitation. Two Photon Absorption, Nonlinear Refraction and Absorption, Self Focussing, Four Wave Mixing, Stimulated Raman Scattering, Stimulated Brillouin Scattering, Optical Bistability, Optical Phase Conjugation.

References

1. Y. R. Shen, The Principles of Nonlinear Optics, Wiley, New York 1984.
2. C. Flytzanis and J. L. Oudar, Nonlinear Optics : Device and Application, Springer Verlag, Berlin, 1986.
3. C. Hanna, M. Yuratich and D. Cotter, Nonlinear Optics of Free atoms and Free Molecules, Springer-verlag, Berlin 1979.
4. A. Yariv, Quantum Electronics, IInd Edition Wiley, New York, 1975.

Unit III Nanotechnology:-

- (a) Idea of Quantum Well Structures, Quantum Dots.
- (b) Different Methods of Preparation of Nano Particles, Cluster Beam Evaporation, Ion Beam Deposition, Ball Milling.

References

1. Physics of Semiconductor Nanostructures by K. P. Jain, Narosa, 1977.
2. Nanoparticles and Characterization and Application Ed. J. H. Fendler, John Wiley and Sons 1998.

Unit IV

(a) **Symmetries and Quarks:-** Symmetries in Physics, Symmetries and Groups, The Groups SU(2), Finite Symmetry Groups P and C, SU(2) of Isospin, Isospin of Antiparticles. The Group SU(3).

(b) **Quantum Chromodynamics:-** Flavours and Colour Factors- Standard Model, Unification Scheme, Parity, Charge Conjugation, CP Violation, Time reversal and TCP Theorem.

References

1. Introduction to Elementary Particle Physics by David Griffith, Harper & Row, New York.
2. Quarks and Leptons by F. Halzen and A. Martin, John Wiley & Sons, New York.