University of Rajasthan
Jaipur

SYLLABUS

M.Sc. PHYSICS

(Annual Scheme)

M.Sc. (Previous) Examination  2019
M.Sc. (Final) Examination  2020

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR
NOTICE

The Ordinance governing the examinations in the

Conformity and Law are contained in a separate booklet.

Partly as Fine Arts, Fine Social Sciences, Science,

Survey Report/Fielld/Disccussion/Tests

Each Theory Paper

100 Marks

3. Examination

The number of papers and the maximum marks for each paper

100 Marks

(Ammendment)

SCHEME OF EXAMINATION
Section A
Questions from each section
1. In this question, 10% of the marks are reserved for students who have scored 50% or above in the previous examination. (Please provide the details of the paper to be taken in.

Note: In all questions, marks must be answered correctly to qualify for the examination. Only correct answers shall be considered in the evaluation. The total marks for each question shall be reduced by 25% for each incorrect answer.

Duration: 3 hours
Max. Marks: 100

Methods in Physics

Paper I: Classical Mechanics and Mathematical

Time: 3 hours
Max. Marks: 100

Electromagnetic Theory

Paper II: Classical Electronics

Time: 3 hours
Max. Marks: 100

Paper III: Quantum Physics

Total Marks: 300

Section C
Physics Questions

Paper I: Classical Mechanics and Mathematical

Time: 3 hours
Max. Marks: 100

Optional Question: Quantum Physics

Paper II: Classical Electronics

Time: 3 hours
Max. Marks: 100

Paper III: Quantum Physics

Max. Marks: 100

A candidate earns any 2 papers (Papers I, II, or III) in Physics Section C.

Note: No candidate can earn more than 100 marks in each section.
Section A

1. Theoretical Description of Maxwell's Equations
2. Electromagnetic Field: Transient State Theory of Faraday's Law and Lenz's Law
3. Electromagnetic Waves: Plane Waves, Wave Equation, and Wave Polarization
4. Electromagnetic Waves in Dielectric Media
5. Electromagnetic Waves in Conducting Media
6. Electromagnetic Waves in Vacuum
7. Electromagnetic Waves in Dielectric Slabs
8. Electromagnetic Waves in Conducting Slabs
9. Electromagnetic Waves in Waveguides
10. Electromagnetic Waves in Cylindrical Waveguides
11. Electromagnetic Waves in Spherical Waveguides
12. Electromagnetic Waves in Plasmas

Section B

1. Quantum Mechanics: Wave Functions and Operators
2. Quantum Mechanics: Eigenvalues and Eigenvectors
3. Quantum Mechanics: Schrödinger Equation
4. Quantum Mechanics: Time-Dependent Schrödinger Equation
5. Quantum Mechanics: Quantum Tunneling
6. Quantum Mechanics: Quantum Entanglement
7. Quantum Mechanics: Quantum Computing

Section C

1. Molecular Physics: Quantum Mechanics of Atoms and Molecules
2. Molecular Physics: Quantum Mechanics of Molecules
3. Molecular Physics: Quantum Mechanics of Ions
5. Molecular Physics: Quantum Mechanics of Quantum States

Section D

1. Advanced Quantum Mechanics: Quantum Field Theory
2. Advanced Quantum Mechanics: Quantum Gravity
3. Advanced Quantum Mechanics: Quantum Entanglement and Quantum Information
4. Advanced Quantum Mechanics: Quantum Computation
5. Advanced Quantum Mechanics: Quantum Cryptography

Section E

1. Advanced Quantum Mechanics: Quantum Computing and Quantum Algorithms
2. Advanced Quantum Mechanics: Quantum Sensing and Quantum Metrology
3. Advanced Quantum Mechanics: Quantum Error Correction
4. Advanced Quantum Mechanics: Quantum Teleportation
5. Advanced Quantum Mechanics: Quantum Communication

Section F

1. Advanced Quantum Mechanics: Quantum Complexity and Quantum Speedup
2. Advanced Quantum Mechanics: Quantum Supremacy and Quantum Advantage
3. Advanced Quantum Mechanics: Quantum Machine Learning
4. Advanced Quantum Mechanics: Quantum Artificial Intelligence
5. Advanced Quantum Mechanics: Quantum Robotics

Section G

1. Advanced Quantum Mechanics: Quantum Sensing and Quantum Metrology
2. Advanced Quantum Mechanics: Quantum Communication and Quantum Cryptography
3. Advanced Quantum Mechanics: Quantum Error Correction and Quantum Information Processing
5. Advanced Quantum Mechanics: Quantum Supremacy and Quantum Advantage

Section H

1. Advanced Quantum Mechanics: Quantum Complexity and Quantum Speedup
2. Advanced Quantum Mechanics: Quantum Machine Learning and Quantum Artificial Intelligence
3. Advanced Quantum Mechanics: Quantum Robotics and Quantum Technology
4. Advanced Quantum Mechanics: Quantum Sensing and Quantum Metrology
5. Advanced Quantum Mechanics: Quantum Communication and Quantum Cryptography
AND COMPUTER PROGRAMMING

PAPER II: ELECTRONIC, NUMERICAL METHOD

7. The Linkage. Acoustic and Molecular Physics
5. A. Thomas and S. L. Quantum Mechanics Theory and
4. L. Park and E. M. Literature Quantum Mechanics—Post-War
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3. Symmetries of Dirac Equation: Lorentz covariance of Dirac equation, proof of covariance and derivation of Lorentz boost and rotation matrices for Dirac spinors. Projection operators involving four momentum and spin, Parity (P), charge conjugation (C), time reversal (T) and CPT operators for Dirac spinors. Bilinear covariants, and their transformations behaviour under Lorentz transformation, P.C.T. and CPT, expectation values of co-ordinate and velocity involving only positive energy solutions and the associated problems, inclusion of negative energy solution, Zitterbewegung, Klein paradox.


Section B


6. The occupation number representation for fermions, second quantization of the Dirac field, the fermion propagator, the e.m. interaction and gauge invariance, covariant quantization of the free electromagnetic field, the photon propagator.

7. S-matrix, the S-matrix expansion, Wick's theorem, Diagrammatic representation in configuration space, the momentum representation, Feynman diagrams of basic processes, Feynman rules of QED.

8. Applications of S-matrix formalism: the Coulomb scattering, Bhabha scattering, Moller scattering, Compton scattering and pair production.

Reference Books :

5. F. Mandal & G. Shaw, Quantum Field Theory (John Wiley).

PEPER - VI : NUCLEAR PHYSICS

Max. Marks 100
Duration 3 hrs.
Note: In all ten questions are to be set. Five from each section. Candidates are required to attempt five questions in all, taking at least two questions from each section.

Section A

1. Two Nucleon system and Nuclear Forces: General nature of the force between nucleons, saturation of nuclear forces, charge independence and spin dependence. General forms of two nucleon interaction, central, noncentral and velocity dependent potentials. Analysis of the ground state (3S1) of deuteron using a square well potential, range-depth relationship, excited states of deuteron. Discussion of the ground state of deuteron under noncentral force, calculation of the electric quadrupole and magnetic dipole moments and the D-state admixture.

2. Nucleon-Nucleon Scattering and Potentials: Partial wave analysis of the neutron-proton scattering at low energy assuming central potential with square well shape, concept of the scattering length, coherent scattering of nucleons by protons in (ortho and para) hydrogen molecule; conclusions of these analyses regarding scattering lengths, range and depth of the potential; the effective range theory (in neutron-proton scattering) and the shape independence of nuclear potential; A qualitative discussion of proton-proton scattering at low energy; General features of two-body scattering at high energy. Effect of exchange forces: Phenomenological hamada-Johnston hard core potential and Reid hard core and soft core potentials; Main features of the One boson Exchange Potentials (OBEP) no derivation.


4. Experimental Techniques: Gas filled counters, Scintillation
equation of motion and stability of the system. The model is constructed using a perturbative approach, taking into account the nonlinear effects and the coupling between the different modes. The resulting equations are derived from a series of approximations, which are valid for small perturbations from the equilibrium state.

The stability of the system is analyzed by examining the eigenvalues of the linearized system. The eigenvalues determine the growth or decay of the perturbations, and thus, the stability properties of the system.

The model predictions are compared with experimental data, and a good agreement is observed.

References:

Figure 1: Schematic diagram of the system.
Section A

1. Introduction to Microwave and RF Electronics

(a) Microwave Waves
(b) RF Power Generation
(c) RF Transmission Lines

2. Microwave Amplifiers
(a) Overview
(b) Amplifier Design
(c) Power Amplifiers

3. Microwave Oscillators
(a) Principles of Operation
(b) Types of Oscillators
(c) Phase Locking

4. Microwave Mixers
(a) Principles of Operation
(b) Types of Mixers
(c) Mixer Performance

5. Microwave Filters
(a) Types of Filters
(b) Design Considerations
(c) Filter Performance

6. Microwave Circuits
(a) Types of Circuits
(b) Design Considerations
(c) Circuit Performance

7. Microwave Antennas
(a) Types of Antennas
(b) Design Considerations
(c) Antenna Performance

8. Microwaves in Communication Systems
(a) Overview
(b) Application Areas
(c) System Design

9. Microwave Energy
(a) Applications
(b) Economic Considerations
(c) Environmental Impact

References

Appendix A: Math Review

Appendix B: Glossary

Appendix C: List of Figures and Tables

Appendix D: Solutions to Selected Problems
Section A

Proposal and Occurrence of Plasma Cigarettes

1. Controlled Thermoclement Reaction: Potential and Problem of

A. Reference:


2. B. Transport: Plasma: Laxation and Conformal


Section B

1. Introduction and Focused: Collision and Diffusion Parameters

2. Collision and Diffusion: Collision and Diffusion Parameters

3. Plasma Parameters: Collision and Diffusion Parameters

4. Collision and Diffusion: Collision and Diffusion Parameters

5. Plasma Parameters: Collision and Diffusion Parameters

6. Plasma Parameters: Collision and Diffusion Parameters

Section C

Definition and Occurrence of Plasma Cigarettes

1. Controlled Thermoclement Reaction: Potential and Problem of

A. Reference:


2. B. Transport: Plasma: Laxation and Conformal


Section D

Proposal and Occurrence of Plasma Cigarettes

1. Controlled Thermoclement Reaction: Potential and Problem of

A. Reference:


2. B. Transport: Plasma: Laxation and Conformal


Study of Kinetic Description

Study of Heat Capacity of Solids

Determination of Density Consistent with a Hydrometer by Balancing

Verification of the Law of Unison Microwaves

Section of K-band

Find the dielectric constant of a gaseous liquid (neat) using a slide

Find the dielectric constant of a xerogel with 10,000 different

On a Polar Diagram paper plot the half power beamwidth and calculate

Study the radiation pattern of a wire dipole with 100 points

Find the lower value for 70% confidence from the graph

Study the simulation of LCR transmission line (radio frequency) and

Summarize the simulation results, and then make a table

Study the characteristics of a gaseous pyrolysis and calibrate the mode

Power Input

To determine the insertion loss and the complete reflectivity of a

To study the properties of a fibre sample using a polarimeter

To study the properties of a fibre sample using a polarimeter

And to obtain band gap using near probe method

To study the complete spectrum of reflection for a semi-conductor

Form factor