Ramaiah University of Applied Sciences

New BEL Road, MSR Nagar, Bangalore – 560054

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

PO, PSO, PEO & CO

Programme Name: M.Sc. in Physics
Programme Code: 104

Programme Outcome (PO)
Programme Specific Outcome (PSO)
Program Educational Objectives (PEO)
Course Outcomes (CO)

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Bangalore-560058

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Faculty of Mathematical & Physical Sciences

Programme Name: M.Sc. (Physics)

Programme Outcomes (PO's)

M.Sc. Physics post graduates will be able to:

PO 1. **Scientific Knowledge:** Apply fundamental knowledge of Physics to solve real life problemsin their chosen domain

PO 2. **Knowledge, Dissemination and Administration:** disseminate knowledge in educational institutions with relevant training and perform administrative duties in government, semi-government, private and public sector organizations

PO 3. **Problem Solving:** Understand and solve scientific problems by conducting experimental investigations

PO 4. **Modern Tool Usage:** Apply appropriate tools, techniques and understand utilization of resources appropriately in various laboratories

PO 5. **Research:** Conduct scientific research and disseminate the knowledge in the chosen domain

PO 6. **The Science, Society and Ethics:** Understand the effect of scientific solutions on legal, cultural, social, public health and safety aspects, and apply ethical principles to scientificpractices and professional responsibilities

PO 7. **Environment and sustainability:** Develop sustainable solutions and understand their effect on society and environment

PO 8. **Individual and teamwork:** Work as a member of a team, to plan and to integrate knowledge of various disciplines as individual and to lead teams in multidisciplinary settings

PO 9. **Communication:** Make effective oral presentations and communicate technical ideas to a broad audience using written and oral means

PO 10. **Life-long learning:** Adapt to the changes and advancements in science and engage in independent and life-long learning

Programme Specific Outcomes (PSOs)

At the end of the M.Sc. Physics program, the graduate will be able to:

PSO-1. Apply the concepts and laws of Physics to solve scientific problems, model, simulate and interpret the results of physical systems.

PSO-2. To enhance the capabilities of students to take up research and perform duties as per scientific protocols in their chosen domains in academics, research institutes and industry as an individual, and as a leader.

PSO-3. Demonstrate ethics, leadership qualities, communication, entrepreneurial skills and involvement in lifelong learning for the betterment of organization, environment and society.

Program Educational Objectives (PEOs)

The objectives of the M.Sc. (Analytical Chemistry) Programme are to:

PEO-1. Provide students a fundamental knowledge in physics to enable them to deliver efficient solutions for complex Scientific problems using analytical and cognitive skills intheir chosen domain.

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PEO-2. Enable students to apply appropriate tools, techniques, methods and understand utilization of resources in laboratories and computational skills in their chosen domain and work as an individual as well as lead team in multidisciplinary settings.

PEO-3. Inculcate ethics, environmental sustainability, communication, soft, managerial and entrepreneurial skills for a successful career in the chosen profession and to engage in lifelong learning and also work towards developing sustainable society.

Course Outcomes (COs)

Course Title & Code: Mathematical Methods of Physics (PYC511A)

After the successful completion of this course, the student will be able to:

CO-1. Explain the basic concepts of Vector analysis, Fourier series and Laplace transform, Complex analysis and special function.

CO-2. Describe various methods of solving physics concepts using mathematical tools of Vector analysis, Fourier series and Laplace transform, Complex analysis and special function.

CO-3. Solve problems on the concepts of Vector analysis, Fourier series and Laplace transform, Complex analysis and special function.

CO-4. Discuss various methods of using mathematical tools of Vector analysis, Fourier series and Laplace transform, Complex analysis and special function

CO-5. Apply mathematical tools for the application in quantum mechanics, classical mechanics, electronics etc.

Course Outcomes (COs)

Course Title & Code: Classical Mechanics (PYC512A)

After the successful completion of this course, the student will be able to:'

CO-1. Explain basic concepts of Lagrangian formulation, Symmetries, central forces, scattering, rigid body dynamics, small oscillations and hamitonian formalism.

CO-2. Describe the main results of System of particles Lagrangian formulation, Symmetries, central forces, scattering, rigid body dynamics, small oscillations and hamitonian formalism.

CO-3. Derive the major equation governing System of particles Lagrangian formulation, Symmetries, central forces, scattering, rigid body dynamics, small oscillations and hamitonian formalism.

CO-4. Solve problems on System of particles Lagrangian formulation, Symmetries, central forces, scattering, rigid body dynamics, small oscillations and hamitonian formalism

CO-5. Apply the results of System of particles Lagrangian formulation, Symmetries, central forces, scattering, rigid body dynamics, small oscillations and hamitonian formalism to relevant examples

Course Outcomes (COs)

Course Title & Code: Quantum Mechanics - 1 (PYC513A)

After the successful completion of this course, the student will be able to:

CO-1. Explain the basic concepts of one-dimensional problems, general formalism, angular momentum and introductory results.

CO-2. Describe the major results of one-dimensional problems, general formalism, angular momentum and introductory results

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CO-3. Derive the major equation governing introductory concepts, one dimensional problems, general formalism and angular momentum.

CO-4. Solve numerical problems on introductory concepts, one dimensional problems, general formalism and angular momentum.

CO-5. Apply the central results of introductory concepts, one dimensional problems, general formalism and angular momentum to relevant examples.

Course Outcomes (COs)

Course Title & Code: Electronics and devices and Laboratory (PYC514A)

After the successful completion of this course, the student will be able to:

CO-1. Explain the basics of electronic devices, opto-electronic Devices, Operational Amplifier and Digital Electronics

CO-2. Describe and derive standard relationships in pn junctions, optoelectronic devices

CO-3. Analyse and design BJT and FET/MOSFET circuits

CO-4. Construct an OPAMP circuit for different applications

CO-5. Conduct appropriate experiments as per the standard procedures and tabulate the measured values and analyze the results

Course Outcomes (COs)

Course Title & Code: General Physics Laboratory (PYL515A)

After the successful completion of this course, the student will be able to:

CO-1. Setup the experimental apparatus required to achieve the stated aim

CO-2. Conduct experiments as per the standard procedures and tabulate the measured values

CO-3. Calculate the required parameters and plot the results

CO-4. Interpret and draw conclusions

CO-5. Write laboratory report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Matlab Laboratory (PYL516A)

After the successful completion of this course, the student will be able to:

CO-1. Understand basic operations of MatLab

CO-2. Write and execute the programmes to learn and understand functions and dictionaries

CO-3. Understand basic operations of Matlab, write and execute Matlab code for required parameters and plot the results

CO-4. Interpret and draw conclusions

CO-5. Write laboratory report as per the prescribed format

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Course Outcomes (COs)

Course Title & Code: Electrodynamics (PYC521A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Understand the basics and explain the concepts of electrostatics, magnetostatics, electromagnetic waves, electromagnetic radiations
- **CO-2.** Derive expressions for electric fields and potentials, magnetic fields, electric field and potential, magnetic field, induced electric field, maxwells equations.
- **CO-3.** Discuss, derive expressions for the electromagnetic waves in different media, E M waves propagation from one medium to another medium, dynamics of charged particles.
- **CO-4.** Discuss, derive expressions for scalar and vector potential, transformations, retarded potentials, Electric dipole radiation, magnetic dipole radiation, Power radiated by a point charge
- **CO-5.** Solve the problems using the concepts of electrostatics, magnetostatics, electrodynamics, electromagnetic wave, electromagnetic radiation

Course Outcomes (COs)

Course Title & Code: Statistical Mechanics and Thermodynamics (PYC522A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss basic concepts of different statistical ensembles, their distribution functions, ranges of applicability and corresponding thermodynamic potentials.
- **CO-2.** Discuss statistical physics methods, such as Boltzmann distribution, Gibbs distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in physical system
- **CO-3.** Discuss statistical methods to analyze phase transitions, Black Body Radiation and Bose-Einstein condensation.
- **CO-4.** Make connections between applications of general statistical theory in various branches of physics
- **CO-5.** Apply statistical physics methods, such as Boltzmann distribution, Gibbs distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in physical system

Course Outcomes (COs)

Course Title & Code: Atomic and Molecular Physics (PYC523A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the basic concepts of spectroscopy, atomic and molecular physics, and lasers
- **CO-2.** Describe various models and derive important mathematical expressions in lasers, atomic and molecular systems
- **CO-3.** Discuss and analyze different types of interactions of matter with external fields, manifestation of their energy levels, applications of lasers, molecular spectroscopy and resonance techniques
- **CO-4.** Solve problems on lasers, spin resonance, and atomic and molecular physics
- **CO-5.** Conduct appropriate experiments as per the standard procedures and tabulate the measured values and analyze the results

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Course Outcomes (COs)

Course Title & Code: Solid State Physics (PYC524A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the basics of crystal structure and crystal systems in terms of lattice and basis of constituent atoms and different thermal and electrical properties of crystals
- **CO-2.** Analyze the relation between crystal symmetry and crystal properties and discuss how X-ray diffraction in crystals can be utilized to determine the crystal structure and other properties
- **CO-3.** Solve numerical problems on crystal structure, x-ray diffraction, thermal and electrical properties of crystals
- **CO-4.** Describe various types of crystal growth techniques and discuss atomic vibrations, heat capacity, thermal expansion and thermoelectric effects in crystalline solids
- **CO-5.** Apply quantum theory to electronic transport properties of metals, semiconductors and superconductors

Course Outcomes (COs)

Course Title & Code: Python Laboratory (PYL525A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Understand the IDE, syntax, algorithms, functions, control structures of Python
- **CO-2.** Understand the functions, control structures of Python
- **CO-3.** Write and execute the programmes to learn and understand control structures, functions, sets, strings, file handling, dictionaries
- **CO-4.** Write and execute the programmes to learn strings, file handling, dictionaries
- **CO-5.** Write laboratory report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Seminar 1 (PYS526A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Conduct a thorough literature review and submit a review article / scientific report
- **CO-2.** Make a presentation to a panel of examiners

Course Outcomes (COs)

Course Title & Code: Numerical Techniques, Computational Physics and Laboratory (CYL526A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain basics of vector spaces and subspaces, elements of computational techniques, importance sampling, mathematical and early approximations, and rigorous foundation on density functional theory.
- **CO-2.** Discuss various numerical techniques and how they are used to obtain approximate solutions to intractable physical problems.
- **CO-3.** Describe the concepts/methods of Kinetic Monte Carlo, Monte Carlo simulation of statistical physics ensembles, Simulated annealing and Quantum Monte Carlo, Hohenberg–

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Kohn Variational theorem and their applications, Kohn–Sham self- consistent field methodology.

CO-4. Solve problems based on various numerical techniques and different Monte Carlo based methods.

CO-5. Write and execute appropriate programs on numerical analysis using Python.

Course Outcomes (COs)

Course Title & Code: Quantum Mechanics - 2 (PYC612A)

After the successful completion of this course, the student will be able to:

CO-1. Explain the basic concepts of Stationery and time dependent approximation methods, Symmetries and conservation laws and relativistic problems.

CO-2. Describe the major results of Stationery and time dependent approximation methods, Symmetries and conservation laws and relativistic problems

CO-3. Derive the major equations governing Stationery and time dependent approximation methods, Symmetries and conservation laws and relativistic problems

CO-4. Solve problems on Stationery and time dependent approximation methods, Symmetries and conservation laws and relativistic problems

CO-5. Apply the results of Stationery and time dependent approximation methods, Symmetries and conservation laws and relativistic problems to relavant examples.

Course Outcomes (COs)

Course Title & Code: Nuclear and Particle Physics (PYC613A)

After the successful completion of this course, the student will be able to:

CO-1. Explain general properties of nucleus, Nuclear Interactions, Detectors and Accelerators, Nuclear Techniques and describe the classification of elementary particles

CO-2. Analyze the structure of nucleus and various nuclear models and derive the important relations in nuclear and particle physics

CO-3. Discuss the various nuclear models and decay modes.

CO-4. Apply the data measurement techniques with detectors

CO-5. Solve problems on nuclear properties, nuclear models, nuclear decay modes, accelerators and particle physics

Course Outcomes (COs)

Course Title & Code: Advanced Solid-State Physics and Laboratory (PYC631A)

After the successful completion of this course, the student will be able to:

CO-1. Explain the basic concepts of Imperfections in Crystals, dielectric, Magnetic Materials, and nanoscience

CO-2. Describe mechanism and properties of Imperfections in Crystals, dielectric, Magnetic Materials, and nanoscience

CO-3. Solve problems on lasers, spin resonance, atomic and molecular physics

CO-4. Discuss the applications of Imperfections in Crystals, dielectric, Magnetic Materials, and nanoscience

CO-5. Conduct appropriate experiments based on solid state physics and nanoscience as per the standard procedures and tabulate the measured values and analyze the results

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Course Outcomes (COs)

Course Title & Code: Nuclear Physics, Nuclear Electronics and Applications (PYC641A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the basic concepts of nucleon-nucleon interactions, collective models, Reaction models, nuclear astrophysics, nuclear electronics and nuclear medicine
- **CO-2.** Describe nucleon forces and various models of nuclear structure and reactions.
  Explain elements of nucleosynthesis
  Describe electronics of components and functions of detector systems. Discuss applications of radioisotopes in the treatment of cancer.
  Describe role of nuclear medicine in dentistry and pediatrics and thyroid disorders.
- **CO-3.** Solve problems on nucleon interactions, nuclear structure and reaction models, nuclear electronics and medicine
- **CO-4.** Discuss the applications of nuclear models, nuclear electronics and radioisotopes in nuclear reactors, accelerator driven systems, astrophysics and nuclear medicine.
- **CO-5.** Perform appropriate experiments as per the standard procedures and tabulate the measured values and analyze the results

Course Outcomes (COs)

Course Title & Code: Research Methodology (MPF614A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the value, scope, relevance and mandatory steps of research as well as principles of effective research
- **CO-2.** Discuss and demonstrate the application and utility of the Systematic approach and out of box thinking concepts for research to be effective
- **CO-3.** Explain and apply the procedures outlined for a systematic Literature Review
- **CO-4.** Outline the principles to prepare a well-structured research proposal and research paper invoking
- **CO-5.** Identify and apply the essential skills desirable for an effective technical presentation

Course Outcomes (COs)

Course Title & Code: Advanced Physics Laboratory (PYL615A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Setup the experimental apparatus required to achieve the stated aim
- **CO-2.** Conduct experiments as per the standard procedures and tabulate the measured values
- **CO-3.** Calculate the required parameters and plot the results
- **CO-4.** Interpret and draw conclusions
- **CO-5.** Write laboratory report as per the prescribed format

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Course Outcomes (COs)

Course Title & Code: Internship (PYI616A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Write a report on experiences during internship
- **CO-2.** Make a presentation to a panel of examiners

Course Outcomes (COs)

Course Title & Code: Seminar 3 (PYS617A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Conduct a thorough literature review and submit a review article / scientific report
- **CO-2.** Make a presentation to a panel of examiners

Course Outcomes (COs)

Course Title & Code: Semiconductor Physics (PYC632A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the basic concepts and the fundamental knowledge from quantum mechanics and solid state physics to the technologically important and useful semiconductor materials and their properties
- **CO-2.** Discuss the transport mechanism and carrier distribution in intrinsic and extrinsic semiconductors and analyze how the conductivity in semiconductors varies with temperature, illumination and doping concentration
- **CO-3.** Solve numerical problems on electron - hole concentration in a semiconductor, PN junction and other semiconductor devices
- **CO-4.** Describe and analyze the characteristics of PN junction, solar cells, photodetectors and other important semiconductor devices
- **CO-5.** Apply the fundamental knowledge from quantum mechanics and solid state physics to design and study the advanced electronic materials.

Course Outcomes (COs)

Course Title & Code: Reactor Physics, Shielding and Safety (PYC642A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the basic concepts of neutron reaction cross sections, neutron multiplication, neutron balance in multiplying media, energy spectra of neutrons, radioactivity evolution, dose and shielding, radiation damage of materials, waste management and environmental impact
- **CO-2.** Describe various models for calculation of effective multiplication factor and neutron growth, discuss diffusion equation and solutions for various geometries, radioactivity equilibria equations, methods of calculation for radiation shielding for complex geometries, event tree and fault tree analysis for accidents, Gaussian plume model for environmental dispersion
- **CO-3.** Solve problems on various reaction rates in reactor systems, kinetics of neutron

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multiplication, diffusion equation for sample material zones and materials, estimation of radiation damage and shield requirement for various sources. Compute probabilities of occurrence of accidents for simple scenarios.
Estimate environmental doses due to emission

CO-4. Discuss the applications in the areas of thermal and fast fission reactor systems including Gen 4 concepts, fusion systems, and accelerator driven systems.

CO-5. Describe various ICRP and AERB principles and regulatory concepts on doses and radioactivity concentrations.

Course Outcomes (COs)

Course Title & Code: Internship - 2 (PYI621A)

After the successful completion of this course, the student will be able to:

CO-1. Write a report on experiences during internship

CO-2. Make a presentation to a panel of examiners

Course Outcomes (COs)

Course Title & Code: Dissertation (PYP622A)

After the successful completion of this course, the student will be able to:

CO-1. Recognize the need for developing a new or improving an existing scientific problem through an organized survey of literature

CO-2. Define scientific problem

CO-3. Design and perform the experiments

CO-4. Analyse the results obtained

CO-5. Write a technical Report and give presentation

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