

# **CURRICULUM & SYLLABUS**



## **CHOICE-BASED CREDIT SYSTEM (CBCS)**

**FOR**

**MASTER OF SCIENCE (M.Sc.)**

**(2 Year Postgraduate Degree Program)**

**IN**

**PHYSICS**

**[w. e. f. 2023-24]**

**FACULTY OF SCIENCE AND HUMANITIES  
SRM UNIVERSITY DELHI-NCR, SONEPAT**

**Plot No.39, Rajiv Gandhi Education City, P.S. Rai, Sonapat Haryana-131029**

## **Vision**

SRM University Haryana aims to emerge as a leading World Class Institution that creates and disseminates knowledge upholding the highest standards of instruction in Engineering & Technology, Science & Humanities, Commerce, Management, Hotel Management & Medicine & Health Science. Along with academic excellence, our curriculum imparts integrity and social sensitivity so that our graduates may best serve the Nation and the World.

## **Mission**

- To create a diverse community campus that inspires freedom and innovation.
- Strengthen Excellence in educational & skill development processes.
- Continue to build productive international alliances.
- Explore optimal development opportunities available to students and faculty.
- Cultivate an exciting and rigorous research environment.

## **SCIENCE GRADUATE EMPLOYMENT ATTRIBUTES:**

- **Able to Apply their Knowledge and Skills in the Disciplinary Area**
- **Analytical & critical thinking and problem-solving skills.**
- **Scientific Temperament Towards Research & Innovation for the Betterment of Society**
- **Efficient Communication & Presentation Skills**
- **Dependability, reliability, responsibility, and independent leadership abilities**

### **M. Sc. PHYSICS PROGRAM EDUCATIONAL OBJECTIVES (PEOs):**

The primary objective of the Master program in Physics is imparting students with an in-depth knowledge and understanding of the subject. While the core courses such as Mathematical Physics, Classical Mechanics, Quantum Mechanics, Statistical Mechanics, and Electrodynamics aims to prepare the students with deep understanding of the fundamental laws of Physics, the elective courses such as Solid-State Physics, Plasma Physics, Electronics, Nuclear and Particle Physics, and Atomic and Molecular Physics should make them familiar with manifestation of these fundamental laws in specific systems or conditions.

Through dissertations and tutorials, it aims to inculcate creative thinking and problem-solving capabilities in the students. The elective and open elective courses are designed in a manner that it will equip the students with a broader knowledge of advanced topics of Physics. The core and elective labs are designed to develop an appreciation for the fundamental concepts and working of devices used in everyday life employing scientific methods/tools of physics. Computational physics course is aimed to equip the students to use computers as a tool for scientific investigations/understanding. The dissertation(s) in both theory and experimental stream are expected to give a flavor of how research leads to new findings. In addition, the M.Sc. course is to lay a solid foundation for a doctorate in Physics/allied subjects later.

### **M. Sc. PHYSICS PROGRAM LEARNING OUTCOMES (PLOs):**

- Understanding the basic concepts of core courses such as classical mechanics, quantum mechanics, statistical mechanics, and electrodynamics to appreciate the underlying principles governing the natural phenomena through logical and mathematical reasoning.
- Understanding the basic concepts of certain advanced fields such as nuclear physics, atomic and molecular physics, solid state physics, plasma physics, and astrophysics, general theory of relativity, nonlinear dynamics, and complex system.
- Learning how to carry out experiments in basic as well as advanced areas of physics.
- Gaining hands-on experience to work in applied fields.
- Developing an attitude and capability for critical thinking and reasoning that can be applied to diverse fields.

### M.Sc. Physics Programme Structure

| S. No. | Course Type                        | No. of Courses | Credits                         | %    |
|--------|------------------------------------|----------------|---------------------------------|------|
| 1      | Core Courses                       | 14             | $14 \times 4 + 2 \times 2 = 52$ | 57.8 |
| 2      | Generic (GE)                       | 2              | $2 \times 4 = 8$                | 8.9  |
| 3      | Discipline Specific Elective (DSE) | 6              | $6 \times 4 = 24$               | 26.7 |
| 4      | Project                            | 1              | 06                              | 6.7  |
|        | Total                              | 23             | 90                              | 100  |

## M.Sc. Physics Programme structure component-wise distribution

| S. No . | Course Type                        | No. of Courses | Component | Course division | Credits                       | Total Credit | %     |
|---------|------------------------------------|----------------|-----------|-----------------|-------------------------------|--------------|-------|
| 1       | Core Courses                       | 14             | Theory    | 10              | $10 \times 4 = 40$            | 52           | 57.8% |
|         |                                    |                | Practical | 4               | $2 \times 2 + 2 \times 4 = 4$ |              |       |
| 2       | Generic Elective (GE )             | 2              | Theory    | 2               | $2 \times 4 = 8$              | 8            | 8.9%  |
| 3       | Discipline Specific Elective (DSE) | 6              | Theory    | 4               | $4 \times 4 = 16$             | 24           | 26.7% |
|         |                                    |                | Practical | 2               | $2 \times 4 = 8$              |              |       |
| 4       | Project                            | 1              | --        | 1               | $1 \times 6 = 6$              | 6            | 6.7%  |
|         | Total                              | 23             | Theory    | $64/90 = 71\%$  |                               | 90           | 100%  |

## SUMMARY OF CREDITS

| Category                                | I Sem | II Sem | III Sem | IV Sem | Total | %    |
|---|-------|--------|---------|--------|-------|------|
| <b>CORE</b>                             | 20    | 18     | 10      | 04     | 52    | 57.8 |
| <b>GENERIC ELECTIVE</b>                 | 04    | 04     | -       | -      | 08    | 8.9  |
| <b>DISCIPLINE SPECIFIC<br/>ELECTIVE</b> | -     | -      | 12      | 12     | 24    | 26.7 |
| <b>PROECT</b>                           | -     | -      | -       | 06     | 06    | 6.7  |
| <b>TOTAL</b>                            | 24    | 22     | 22      | 22     | 90    | 100  |



### **COURSE REVISION DETAILS**

1. Following discipline-specific elective paper introduced:
  - a. Quantum Field Theory
  - b. Quantum Informatics and Quantum Computation.

## M.Sc. Physics - SEMESTER-I

| Code       | Category           | Course                             | L  | T | P | C  |
|------------|--------------------|------------------------------------|----|---|---|----|
| THEORY     |                    |                                    |    |   |   |    |
| 23PHMS 101 | Core Course        | Mathematical Physics               | 3  | 1 | 0 | 4  |
| 23PHMS 102 |                    | Classical Mechanics                | 3  | 1 | 0 | 4  |
| 23PHMS 103 |                    | Quantum Mechanics I                | 3  | 1 | 0 | 4  |
| 23PHMS 104 |                    | Electrodynamics                    | 3  | 1 | 0 | 4  |
| 23OEPH101  | Generic Elective I | Clean and Renewable energy Physics | 3  | 1 | 0 | 4  |
| 23OEPH102  |                    | Biophysics                         |    |   |   |    |
| PRACTICAL  |                    |                                    |    |   |   |    |
| 23PHMS 151 | Core               | Physics Lab I (General)            | 0  | 0 | 8 | 4  |
| Total      |                    |                                    | 15 | 5 | 8 | 24 |

## M.Sc. Physics - SEMESTER-II

| Code       | Category            | Course                      | L  | T | P  | C  |
|------------|---------------------|-----------------------------|----|---|----|----|
| THEORY     |                     |                             |    |   |    |    |
| 23PHMS 201 | Core Course         | Solid State Physics         | 3  | 1 | 0  | 4  |
| 23PHMS 202 |                     | Quantum Mechanics II        | 3  | 1 | 0  | 4  |
| 23PHMS 203 |                     | Electronics                 | 3  | 1 | 0  | 4  |
| 23OEPH201  | Generic Elective II | MATLAB                      | 3  | 1 | 0  | 4  |
| 23OEPH202  |                     | Programming in C            |    |   |    |    |
| PRACTICAL  |                     |                             |    |   |    |    |
| 23PHMS 251 | Core                | Physics Lab II (General)    | 0  | 0 | 8  | 4  |
| 23PHMS 252 | Core                | Computational Physics Lab I | 0  | 0 | 4  | 2  |
| Total      |                     |                             | 12 | 4 | 12 | 22 |

## M.Sc. Physics - SEMESTER-III

| Code       | Category                        | Course                             | L  | T | P  | C  |
|------------|---------------------------------|------------------------------------|----|---|----|----|
| THEORY     |                                 |                                    |    |   |    |    |
| 23PHMS 301 | Core Course                     | Atomic & Molecular Physics         | 3  | 1 | 0  | 4  |
| 23PHMS 302 |                                 | Statistical Mechanics              | 3  | 1 | 0  | 4  |
| 23PHMS 303 | Discipline Specific Elective 1  | Advanced Solid State Physics I     | 3  | 1 | 0  | 4  |
| 23PHMS 304 |                                 | Nanomaterials                      |    |   |    |    |
| 23PHMS 305 |                                 | Soft Matter Physics                |    |   |    |    |
| 23PHMS 306 |                                 | Laser Physics & Applications       |    |   |    |    |
| 23PHMS 307 |                                 | Nanophotonics                      |    |   |    |    |
| 23PHMS 308 |                                 | Nonlinear Spectroscopy             |    |   |    |    |
| 23PHMS 309 |                                 | Analog Communication               |    |   |    |    |
| 23PHMS 310 |                                 | Digital Communication              |    |   |    |    |
| 23PHMS 311 |                                 | Optoelectronics                    |    |   |    |    |
| 23PHMS 312 | Discipline specific Elective II | Nuclear Physics I                  | 3  | 1 | 0  | 4  |
| 23PHMS 313 |                                 | Astrophysics I                     |    |   |    |    |
|            |                                 | Quantum Field Theory               |    |   |    |    |
| PRACTICAL  |                                 |                                    |    |   |    |    |
| 23PHMS 351 | Core Lab                        | Computational Physics Lab II       | 0  | 0 | 4  | 2  |
| 23PHMS352  | Discipline specific Lab         | Advanced Solid State Physics Lab I | 0  | 0 | 8  | 4  |
| 23PHMS353  |                                 | Laser & Spectroscopy Lab I         |    |   |    |    |
| 23PHMS354  |                                 | Electronics Lab I                  |    |   |    |    |
| Total      |                                 |                                    | 12 | 4 | 12 | 22 |

**Note:** The student will opt any one option which will be continued in IV Semester as well.

## M.Sc. Physics - SEMESTER-IV

| Code       | Category                                    | Course  | L  | T | P  | C  |
|------------|---|---|----|---|----|----|
| Theory     |   |   |    |   |    |    |
| 23PHMS 401 | Core Course                                 | Nuclear and Particle Physics                    | 3  | 1 | 0  | 4  |
| 23PHMS 402 | Discipline Specific Elective III            | Advanced Solid State Physics II                 | 3  | 1 | 0  | 4  |
| 23PHMS 403 |   | Characterization of materials                   |    |   |    |    |
| 23PHMS 404 |   | Nanomagnetism And Spintronics                   |    |   |    |    |
| 23PHMS 405 |   | Fiber Optics Sensors                            |    |   |    |    |
| 23PHMS 406 |   | Applied Optics                                  |    |   |    |    |
| 23PHMS 407 |   | Rotational & Vibrational Molecular Spectroscopy |    |   |    |    |
| 23PHMS 408 |   | Novel and Smart Materials                       |    |   |    |    |
| 23PHMS 409 |   | Microprocessor & Interfacing                    |    |   |    |    |
| 23PHMS 410 |   | Discipline specific Elective IV                 |    |   |    |    |
| 23PHMS 411 | Nuclear Physics II                          |   |    |   |    |    |
| 23PHMS 412 | Astrophysics II                             |   |    |   |    |    |
|            | Quantum Informatics and Quantum Computation |   |    |   |    |    |
| Practical  |   |   |    |   |    |    |
| 23PHMS 451 | Discipline specific Lab                     | CMPLab II                                       | 0  | 0 | 8  | 4  |
| 23PHMS 452 |   | Laser&Spectroscopy Lab II                       |    |   |    |    |
| 23PHMS 453 |   | Electronics Lab II                              |    |   |    |    |
| 23PHMS 491 | Project                                     | Dissertation (Compulsory)                       | 0  | 0 | 12 | 6  |
| Total      |   |   | 12 | 0 | 20 | 22 |