

SCHEME AND SYLLABI FOR

M.Sc. PHYSICS

(TWO YEARS / FOUR SEMESTERS PROGRAMME)

(Under Choice Based Credit System)

1st to 4th semester w. e. f. 2023-24 batch onward


(70:30)



DEPARTMENT OF PHYSICS

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY

HISAR-125001, HARYANA


Chairperson
Department of Physics
Guru Jambheshwar University
of Sc. & Tech., Hisar-125001

Vision and Mission of the Department of Physics

Vision:

To inspire the young students towards understanding and learning the fundamental concepts of Physics and their applications for the development of new technologies in the national interests.

Mission:

Physics is regarded as the most significant subject among all scientific and technical disciplines. The mission of Physics department at Guru Jambheshwar University of Science & Technology is to provide both the undergraduate and postgraduate students strong qualitative and quantitative knowledge along with developing a problem solving attitude that may open up a wide range of career choices. In addition, the mission also includes encouraging the research scholars to conduct cutting- edge research resulting in new discoveries and innovations that expands the horizons of science and technology.

This mission will be accomplished by providing students with rigorous and comprehensive knowledge as well as bringing exciting research perspectives to the student community of Physics Department at Guru Jambheshwar University of Science & Technology.

M.Sc. (Physics): 2 years programme

The Department offers M.Sc. Physics programme which caters to the needs of application oriented world. The programme comprises of Condensed Matter Physics, Materials Science and Laser Physics that forms a major tool for studying ceramics, polymers, ferrites, glass, biomolecules, non-linear optical materials etc. Photonics and Optical Communication are also recurring themes of the present course. The course on computational physics enables the students for computer simulations in research. A course on 'Radiation Physics' is being offered in consultation with Health Physics Division of BARC Mumbai and Radio Ecology Centre has been established in the University. Laboratories are equipped with the modern experimental set up. Optional one semester project work is included in the curriculum for M.Sc. Physics students.

Scheme of M.Sc. Physics (2 Years) Programme
under Choice Based Credit System (w.e.f. 2023-24)

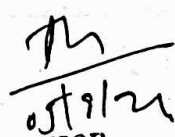
ACADEMIC CURRICULUM

Semester I (Credits = 24, Marks = 600)		Semester II (Credits = 24, Marks = 600)	
P-I	PHL 501: Advanced Mathematical Physics	P-V	PHL 506: Condensed Matter Physics
P-II	PHL 502: Classical Mechanics	P-VI	PHL 507: Atomic and Molecular Spectroscopy
P-III	PHL 503: Quantum Mechanics	P-VII	PHL 508: Statistical Physics
P-IV	PHL 504: Integrated Electronics	P-VIII	PHL 509: Physics of Lasers
Practical-I	PHP 505A: Physics Lab-I	Practical-III	PHP 510A: Physics Lab-III
Practical-II	PHP 505B: Physics Lab-II	Practical-IV	PHP 510B: Physics Lab-IV
Semester III (Credits = 24, Marks = 600)		Semester IV (Credits = 20, Marks = 500)	
P-IX	PHL 511: Nuclear Physics	P-XII	PHL 516: Advanced Quantum Mechanics
P-X	PHL 512: Electrodynamics	PE-II	PHL 517: Group II (A/B/C/D)
P-XI	PHL 513: Computational Physics	PE-III*	PHL 518: Physics of Nano Materials / Spectroscopy/Radiation Physics
PE-I	PHL 514: Group I (A/B/C/D)	Practical-VII	PHP 519A: Physics Lab-VII (Specialization Specific Lab)
Practical-V	PHP 515A: Physics Lab-V (Computational Physics Lab)	Practical-VIII	PHP 519B: Physics Lab-VIII (Specialization Specific Lab)
Practical-VI/ P-I**/Open Elective	PHP 515 B/PHP 500/PHL 500: (Physics Lab-VI (Specialization Lab)/ Project (Part-I, Minor) / Physics for Everyday Life)	OR	
		P-II***	PHP 520: Project (Part-II, Major)

P: Papers; PE: Programme Elective;

Credits and Maximum Marks:

1. Papers (P-I - P-XII); Credits = 06 (04 Theory + 02 Practical/Seminar) each; Total marks 150 each
2. Open Electives (OE); Credits=04; Total marks = 100 each


 Chairperson
 Department of Physics
 Guru Jambheshwar University
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Scheme of M.Sc. Physics (2 Years) Programme under Choice Based Credit System (w.e.f. 2023-24)

Scheme of M.Sc. Physics (2 Years) Programme under Choice Based Credit System (w.e.f. 2023-24)

SEMESTER-I

Paper Code	Course opted	Nomenclature	Credits	Hr/week	Marks		
					Ext.	Int.	Total
PHL 501	P-I	Advanced Mathematical Physics	4	4	70	30	100
PHL 502	P-II	Classical Mechanics	4	4	70	30	100
PHL 503	P-III	Quantum Mechanics	4	4	70	30	100
PHL 504	P-IV	Integrated Electronics	4	4	70	30	100
PHP 505A	Practical-I	Physics Lab-I	4	8	70	30	100
PHP 505B	Practical-II	Physics Lab-II	4	8	70	30	100
		Total	24	32			

NOTE:

The nomenclature and content of Paper Code PHL 501 and MPL 101 are same.
 The nomenclature and content of Paper Code PHL 502 and MPL 102 are same.
 The nomenclature and content of Paper Code PHL 503 and MPL 103 are same.
 The nomenclature and content of Paper Code PHL 504 and MPL 104 are same.

SEMESTER-II

Paper Code	Course opted	Nomenclature	Credits	Hr/week	Marks		
					Ext.	Int.	Total
PHL 506	P-V	Condensed Matter Physics	4	4	70	30	100
PHL 507	P-VI	Atomic and Molecular Spectroscopy	4	4	70	30	100
PHL 508	P-VII	Statistical Physics	4	4	70	30	100
PHL 509	P-VIII	Physics of Lasers	4	4	70	30	100
PHP 510 A	Practical-III	Physics Lab-III	4	8	70	30	100
PHP 510 B	Practical-IV	Physics Lab-IV	4	8	70	30	100
		Total	24	32			

NOTE:

The nomenclature and content of Paper Code PHL 506 and MPL 201 are same.
 The nomenclature and content of Paper Code PHL 507 and MPL 202 are same.
 The nomenclature and content of Paper Code PHL 508 and MPL 203 are same.
 The nomenclature and content of Paper Code PHL 509 and MPL 204 are same.

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SEMESTER-III

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
PHL 511	P-IX	Nuclear Physics	4	4	70	30	100
PHL 512	P-X	Electrodynamics	4	4	70	30	100
PHL 513	P-XI	Computational Physics	4	4	70	30	100
PHL 514	PE-I	Group I (A/B/C/D)	4	4	70	30	100
PHP 515A	Practical-V	Physics Lab-V (Computational Physics Lab)	4	8	70	30	100
PHP 515 B /PHP 500 /PHL500: Practical- VI/P-I**/Open Elective	Physics Lab-VI /Project (Part-I, Minor)** / Physics for Everyday Life	Physics Lab-VI (Specialization Lab) /Project (Part-I, Minor) / Physics for Everyday Life ⁵	4	4	70	30	100
		Total	24	28			

The nomenclature and content of Paper Code PHL 511 and MPL 301 are same.

The nomenclature and content of Paper Code PHL 512 and MPL 302 are same.

The nomenclature and content of Paper Code PHL 513 and MPL 303 are same.

The nomenclature and content of Paper Code PHL 514(i) and MPL 304(i) / PHL 514(ii) and MPL 304(ii) / PHL 514(iii) and MPL 304(iii) / PHL 514(iv) and MPL 304(iv) are same.

SEMESTER-IV

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
PHL 516	P-XII	Advanced Quantum Mechanics	4	4	70	30	100
PHL 517	PE-II	Group-II (A/B/C/D)	4	4	70	30	100
PHL 518	PE-III*	Physics of Nano material / Spectroscopy/Radiation Physics	4	4	70	30	100
PHP- 519A	Practical-VII	Physics Lab-VII (Specialization Specific Lab)	4	4	70	30	100
PHP- 519B	Practical-VIII	Physics Lab-VIII (Specialization Specific Lab)	4	4	70	30	100
		Total	20				

The nomenclature and content of Paper Code PHL 516 and MPL 401 are same.

The nomenclature and content of Paper Code PHL 517(i) and MPL 402(i)/ PHL 517(ii) and MPL 402(ii) / PHL 517(iii) and MPL 402(iii) / PHL 517(iv) and MPL 402(iv) are same.

The nomenclature and content of Paper Code PHL 518 and MPL 403 are same.

OR

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
PHP 520*	Project (Major)***	Project (Part-II, Major)	20		350	150	500

Important Notes:

1. The question paper shall contain 20% numerical problems in the relevant papers.
2. The department may offer one of the papers (up to 4 credit) to be done through MOOC/SWAYAM courses in a year/semester. The student shall be graded as per the evaluation done by these online courses.
3. A student may opt for the respective MOOC's courses at their own in place of PEs with a maximum of 8 credits during the programme.
4. The 4 credits assigned to Physics Lab shall include seminar and that will be a part of internal evaluation.
5. The student has to opt for PE-I and PE-II from respective groups (Table 1) keeping in view the related papers of his/her area of interest. The courses will be offered depending upon the strength of students (Minimum 10 students and maximum 50% of the strength of students in a particular class) for a particular course of option subject to availability of faculty. Student is required to opt same discipline /specialization from the two groups.

TABLE-1

Option	Group-I	Group-II
A	PHL514(i) Materials Science-I	PHL517(i) Materials Science-II
B	PHL514(ii) Photonics-I (Fibre Optics and Communication)	PHL517(ii) Photonics – II (Nonlinear Optics)
C	PHL514(iii) Advanced Nuclear Physics-I (Nuclear Models)	PHL517(iii) Advanced Nuclear Physics-II (Nuclear Reactions)
D	PHL514(iv) Theoretical Condensed Matter Physics-I	PHL517(iv) Theoretical Condensed Matter Physics-II

* The student will be offered one of the papers for PE-III (PHL-518) from Physics of Nano materials/Spectroscopy/Radiation Physics subject to availability of faculty.

**The minor project will be given to top 20% students of the total strength in the programme. The students for minor project will be selected based on their previous semester marks or results declared semester whichever is available. In minor project, the students are required to carry out literature review/research work under the guidance of assigned supervisor by the department. At the end of the semester, a 10-15 pages' project report (Part-I, Minor, PHP 500) will be submitted and the same will be evaluated internally through presentation in front of the committee of 3-4 Teachers (including at least one Professor, constituted by the chairperson). Internal evaluation of 100 marks will comprise of 70:30, where 70 marks will be awarded by the committee and 30 marks by the concerned supervisor. Rest of the students

will perform practical or a 4-credit course to be opted by the students as per elective course from other departments.

The candidate shall be required to submit statement of purpose (SOP) if he/she wishes to undertake major project (PHP 520) in final semester (Semester- IV) along with the consent from one of the regular faculty members of the department for supervision (The faculty can give consent to one student only). The SOP will be evaluated by four member's committee chaired by Chairperson along with supervisor as one of the members.

- The criteria for selection of students for major project (PHP 520) in final semester (Semester- IV) is as under:
 - i) The students must have passed all the lower semester exams (1st to 2nd semester).
 - ii) The students' merit will be framed as follows:
 - a) 50% weightage from 1st & 2nd semester aggregates marks
 - b) 25% weightage of minor project marks (PHP 500)
 - c) 25% weightage of SOP evaluation
- The guidelines for SOP will be provided by the department.
- A student opting for major project (PHP 520) is required to undertake 16-20 weeks' (one semester) project in semester IV. He/she is supposed to submit acceptance-cum-recommendation letter from a Faculty from a National level institution / 'A' grade University including GJUS&T by the end of IIIrd semester.

The evaluation of major project report & presentation out of 500 marks will be done as follows:

1. 150 marks by the concerned supervisor based on overall internal assessment.
2. 200 marks through presentation of major project before four member's committee chaired by Chairperson (Each member to award out of 50 marks)
3. 150 marks by inviting the external examiner in the relevant area. The external examiner may be asked to evaluate up to the maximum of 10 students in the relevant area.

⁵ PHL-500 Elective Paper: Physics for everyday life is to be offered to the students of other department of the university.

PHP 515 A: Physics Lab-V (Computational Physics Lab)

Marks (External) : 70

Credits : 4

Marks (Internal Assessment) : 30

Time : 6 Hrs

1. Each student should perform at-least Ten experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

List of Experiments:

1. Numerical integration using (a) Simpson 1/3 and (b) Gauss quadrature methods for one and two dimensional integrals.
2. Least square fitting (Linear).
3. To find eigen values and eigen vectors of a square matrix using power method.
4. Solution of second order differential equation using Runge –Kutta method.
Application: Eigen values and eigenfunctions of a linear harmonic oscillator using Runge – Kutta method.
5. Solution of simultaneous linear algebraic equations by Gauss Jordan elimination method.
Application: Illustration of Kirchoff's laws for simple electric circuits.
6. Interpolation and Extrapolation by using Lagrangian method and Newton Forward Interpolation formula.
7. To find the area of a circle by Monte – Carlo technique.
8. Simulation of nuclear radioactivity by Monte- Carlo technique.
9. Simulation of Brownian motion using Monte- Carlo technique.
10. To solve simultaneous linear equations using Gauss –Elimination method.
11. Study of frequency response curve for LCR Circuits.
12. Dynamics of damped driven pendulum.

PHP 515 B: Physics Lab-VI (Specialization Specific Lab)

PHP-515B(i)-Materials Science Lab-I

Marks (External) : 70

Credits : 4

Marks (Internal Assessment) : 30

Time : 6 Hrs

1. Each student should perform at-least Six experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

The experiments will comprise related to the specialization opted in Semester-III.

PHP-515B(ii)-Photonics Lab-I

Marks (External) : 70

Credits : 4

Marks (Internal Assessment) : 30

Time : 6 Hrs

1. Each student should perform at-least Six experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

The experiments will comprise related to the specialization opted in Semester-III.

PHP-515B(iii)-Advanced Nuclear Physics Lab-I

Marks (External) : 70

Credits : 4

Marks (Internal Assessment) : 30

Time : 6 Hrs

1. Each student should perform at-least Six experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

The experiments will comprise related to the specialization opted in Semester-III.

PHP-515B(iv)-Theoretical Condensed Matter Physics Lab-I

Marks (External) : 70


Credits : 4

Marks (Internal Assessment) : 30

Time : 6 Hrs

1. Each student should perform at-least Six experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

The experiments will comprise related to the specialization opted in Semester-III


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OR

PHP 500: PROJECT (PART-I, MINOR)

Marks (Internal evaluation): 70

Credits: 4

Marks (Internal Assessment): 30

In minor project, the students are required to carry out literature review/research work under the guidance of assigned supervisor by the department. At the end of the semester, a 10-15 pages' project report (Part-I, Minor, PHP 500) will be submitted and the same will be evaluated internally through presentation in front of the committee of 3-4 Teachers (including at least one Professor, constituted by the chairperson). Internal evaluation of 100 marks will comprise of 70:30, where 70 marks will be awarded by the committee and 30 marks by the concerned supervisor.

OR

Open elective paper (To be opted by students of other departments)

OR
Experiment Lab

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Open Elective

(To be opted by students of other departments)

PHL 500: Physics for Everyday Life

Marks (Theory): 70

Credits: 4 (60 lectures)

Marks (Internal Assessment): 30

Time: 3 Hrs

Note: Paper setter is to set nine questions in all. Question no. 1 (compulsory based on the entire syllabus) will consist of seven short answer type questions, each of two marks. Rest of Eight questions is to be set uniformly selecting two questions from each Unit. A student is required to attempt five questions in all selecting one from each Unit and a compulsory question 1. The question paper shall contain 20% numerical problems in the relevant papers.

Course Objective: To provide an introduction to popular concepts of Physics in day to day life through constructive critical analysis of physics in sports, light in life, communication and information technology, renewable energy sources etc.

Course Outcome: After going through the course, students will be able to know the role of physics behind various phenomenon occurring in our surrounding.

Unit-I

Physics in sports: Swimming - Forces acting on a floating body, Forces acting on a swimmer moving through the water, Dolphin kick. Golf- the Golf Swing, Aerodynamics of Ball flight. Gymnastics- The still rings, Trampoline. Pole Vaulting. Running-Forces generated during running, Path travelled by runners and center of mass, Arm swinging.

Unit-II

Light in Life: Introduction to lasers, its basic characteristics and working, Types of lasers, Application of laser in Industry (cutting, drilling, welding, material processing, etc.), Medicine (skin and eyes cosmetic surgery, Optical coherent tomography, Photo dynamic therapy & other treatments), Communication (digital and satellite communication, Defence etc.),

Unit-III


Communication & Information Technology- Introduction to Optical fiber Principle working, Types of Fibers, communication: Sources and Detectors, Satellite Communications: Satellite Orbits, Geostationary orbits, Applications of satellite in Communication, Telephones, Television, Radio Broadcasting (AM and FM communication), Military, GPS, Weather forecasting etc.

Unit-IV

Renewable Energy: Solar energy: Solar Cells its types and applications Wind Power, Hydropower, Geothermal energy, Bio energy. Commercialization: Indian Economic Trends, industry & policy trends. Status of Indian energy sector and future plans.

Reference Books:

1. Lasers Fundamentals, W.T. Silfvast, Cambridge (1996)
2. Optical communication, M. MukundaRao, Universities Press (2000)
3. <https://www.real-world-physics-problems.com/physics-of-sports.html>
4. <https://www.topendsports.com/biomechanics/physics.htm>
5. <http://www.authorstream.com/Presentation/Vedang-711005-application-of-physics-in-sports/>
6. http://www.indiaenergyportal.org/overview_detail.php
7. A Review of Solar Energy: Markets, Economics and Policies by Govinda R. Timilsina, Lado Kurdgelashvili and Patrick A. Narbel document for The World Bank Development Research Group Environment and Energy Team, October 2011
8. Solar energy: Principles and possibilities, Science Progress (2010), 93(1), 37-112doi: 10.3184/003685010X12626410325807


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PHP 519A: PHYSICS LAB-VII (Specialization Specific Lab)

PHP-519A(i)-Materials Science Lab-II

Marks (External) : 70

Credits : 4

Marks (Internal Assessment) : 30

Time : 6 Hrs

1. Each student should perform at-least Six experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

The experiments will comprise related to the specialization opted in Semester-III.

PHP-519A(ii)-Photonics Lab-II

Marks (External) : 70

Credits : 4

Marks (Internal Assessment) : 30

Time : 6 Hrs

4. Each student should perform at-least Six experiments.
5. The students are required to calculate the error involved in a particular experiment.
6. List of experiments may vary.

The experiments will comprise related to the specialization opted in Semester-III.

PHP-519A(iii)-Advanced Nuclear Physics Lab-II

Marks (External) : 70

Credits : 4

Marks (Internal Assessment) : 30

Time : 6 Hrs

4. Each student should perform at-least Six experiments.
5. The students are required to calculate the error involved in a particular experiment.
6. List of experiments may vary.

The experiments will comprise related to the specialization opted in Semester-III.

PHP-519A(iv)-Theoretical Condensed Matter Physics Lab-II

Marks (External) : 70

Credits : 4

Marks (Internal Assessment) : 30

Time : 6 Hrs

4. Each student should perform at-least Six experiments.
5. The students are required to calculate the error involved in a particular experiment.
6. List of experiments may vary.

The experiments will comprise related to the specialization opted in Semester-III

PHP 519B: PHYSICS LAB-VIII (Specialization Specific Lab)

PHP-519B(i)-Materials Science Lab-III

Marks (External) : 70

Credits : 4

Marks (Internal Assessment) : 30

Time : 6 Hrs

1. Each student should perform at-least Six experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

The experiments will comprise related to the specialization opted in Semester-IV.

PHP-519B(ii)-Photonics Lab-III

Marks (External) : 70

Credits : 4

Marks (Internal Assessment) : 30

Time : 6 Hrs

1. Each student should perform at-least Six experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

The experiments will comprise related to the specialization opted in Semester-IV.

PHP-519B(iii)-Advanced Nuclear Physics Lab-III

Marks (External) : 70

Credits : 4

Marks (Internal Assessment) : 30

Time : 6 Hrs

1. Each student should perform at-least Six experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

The experiments will comprise related to the specialization opted in Semester-IV.

PHP-519B(iv)-Theoretical Condensed Matter Physics Lab-III

Marks (External) : 70

Credits : 4

Marks (Internal Assessment) : 30

Time : 6 Hrs

1. Each student should perform at-least Six experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

The experiments will comprise related to the specialization opted in Semester-IV

PHP 520: Project (Major)

Marks: 500

Credits: 20

The candidate shall be required to submit statement of purpose (SOP) if he/she wish to undertake major project (PHP-520) in final semester (Semester- IV) along with the consent from one of the regular faculty member of the department for supervision (The faculty can give consent to one student only). The SOP will be evaluated by four member's committee chaired by Chairperson along with supervisor as one of the member.

- *The criteria for selection of students for major project (PHP 520) in final semester (Semester- IV) is as under:*
 - i) *The students must have passed all the lower semester exams (1st to 2nd semester).*
 - ii) *The students' merit will be framed as follows:*
 - a) *50% weightage from 1st & 2nd semester aggregates marks*
 - b) *25% weightage of minor project marks (PHP 500)*
 - c) *25% weightage of SOP evaluation*
- *The guidelines for SOP will be provided by the department.*
- *A student opting for major project (PHP 520) is required to undertake 16-20 weeks' (one semester) project in semester IV. He/she is supposed to submit acceptance-cum-recommendation letter from a Faculty from a National level institution / 'A' grade University including GJUS&T by the end of IIIrd semester.*

The evaluation of major project report & presentation out of 500 marks will be done as follows:

1. *150 marks by the concerned supervisor based on overall internal assessment.*
2. *200 marks through presentation of major project before four member's committee chaired by Chairperson (Each member to award out of 50 marks)*
3. *150 marks by inviting the external examiner in the relevant area.*

The external examiner may be asked to evaluate up to the maximum of 10 students in the relevant area