Shri Mata Vaishno Devi University
श्री माता वैष्णो देवी विश्वविद्यालय
Kakryal, Katra-182320 (J&K), India
School of Physics

Minutes of the 14th Meeting of Board of Studies of SoP

For the record, the Chair commenced the meeting by expressing sincere appreciation to the esteemed member experts of the previous BoS, SoP, for their valuable contributions. He then extended a warm welcome to all reconstituted Board members, with special mention of the newly inducted external experts, **Prof. Prabhakar Singh**, Professor, Dept. of Physics, IIT BHU, and **Dr. Ashok Bera**, Associate Professor, Dept. of Physics, IIT Jammu.

Prof. Singh joined the meeting in online mode, while Dr. Bera attended in person. The Chair acknowledged and appreciated their gracious presence and the time they spared from their demanding schedules to deliberate on the agenda items of the 14th BoS meeting.

Agenda Item No. 14.1:

To confirm the Minutes of the 13th Meeting of the Board of Studies, School of Physics, held on 17th July, 2025.

Resolution :

The Board confirmed the minutes of the 13th meeting of the Board of Studies (BoS), School of Physics (SoP), held on 17 July 2025, which had been circulated vide Ref. No. SMVDU/SoP/25/111 dated 30-07-2025. The same are placed at **Annexure-I** for reference.

Agenda Item No. 14.2:

To consider and approve the detailed syllabi and course contents of Ist year of the Two-Year Postgraduate (PG) Programme in Physics, applicable to students admitted from Academic Year 2025–26 and onwards under the NEP 2020 framework.

Resolution :

Following detailed deliberations and valuable inputs from the members, the Board of Studies (BoS) approved the comprehensive course contents for the first year of the Two-Year Postgraduate (PG) Programme in Physics. The approved curriculum shall be applicable to students admitted from the Academic Year 2025–26 onwards under the NEP 2020 framework. The same is appended as **Annexure-II**.

Agenda Item No. 14.3:

To consider and approve the revised list of experiments for the course Engineering Physics Lab (PHP BS101), consequent upon the inclusion of new experiments, applicable to B.Tech. students to be admitted from Academic Year 2026–27 onwards.

Resolution :

After detailed deliberations and constructive suggestions from the esteemed members, the Board of Studies (BoS) approved the revised list of experiments for the Engineering Physics Lab (PHP BS101) course. The revised scheme shall be applicable to B.Tech. students admitted from the Academic Year 2026–27 onwards and is annexed as **Annexure-III**.

Agenda Item No. 14.4:

To discuss thoroughly the proposed course structure for the Minor Programme in Quantum Technology for B.Tech. Computer Science students to be admitted from Academic Year 2026–27 onwards.

Resolution :

The Board deliberated extensively on the proposed course structure for the Minor Programme in Quantum Technology intended for B.Tech. Computer Science students to be offered from the Academic Year 2026–27 onwards.

The Board observed that, given the present limited faculty strength and constrained infrastructural resources within the School, it would be challenging to effectively implement and sustain the Minor Programme at this stage. During the deliberations, the expert form IIT Jammu highlighted that even they are finding it difficult to run this minor programme due to non-availability of the expert faculty members for some of the courses required in quantum technology. However, it was noted that, should the programme be mandated for commencement, the School may explore engaging guest faculty from other institutes and universities to ensure its smooth conduct. After careful consideration, the Board kept the proposal in abeyance.

Agenda Item No. 14.5:

To include one extra elective course on numerical computation/ programming techniques in the two year PG curriculum.

Resolution :

It was suggested by member expert Dr. Ashok Bera to include one extra elective course on numerical computation/ programming techniques in the two year PG curriculum. The board noted the suggestion and recommended it to be introduced in near future.

Agenda Item No. 14.6:

To report the various other items happened in the school since 13th BoS meeting.

Resolution :

The external member experts appreciated the efforts put in by the in-house board members to design the syllabi in up-to-date and well-planned manner for two year PG programme as per NEP 2020. The following activities/ events took place in the Sop since 13th BoS meeting.

1. The school organized two days **Trekking cum Educational Trip to Pancheri hills,** Udhampur for graduate, post-graduate and research students.
2. The school organized a 2-week Refresher Course on **"Material Science and Its Applications"** w.e.f. 8th Dec., 2025 to 20th Dec., 2025 under UGC-MMTTC, SMVDU.
3. One Research Scholar **Ms. Arti Khajuria** (Entry No.: 20DPH005) declared qualified for **CSIR NET-JRF (December 2025)** in Physical Sciences.

4. In the 11th convocation, the following students from the School of Physics were awarded with the **Ph.D. degree** :

   (a) Varun Bali (19DPH002)

   (b) Neha Lalotra (20DPH002)

   (c) Vishav Deep Sharma (19DPH001)

5. The school organized an **International Webinar on Visualization of Nano-world** with **Dr. Vikram Raghuwanshi** (Senior X-Ray Scientist, University of Queensland, Australia) as the Resource person in online mode on 7th October, 2025.

6. **Dr. Anupam Kumar Sharma**, Assoc. Prof. SoP, delivered an **Invited Talk** in 1st international conference on "Recent advancement in Physical Sciences" organized by Dept. of Physics, **NIT Uttrakhand** on Feb. 6-8, 2026.

7. **Dr. Pankaj Biswas**, Asst. Prof., School of Physics, Shri Mata Vaishno Devi University, **presented a research paper** in the recently held International Conference (**POLY-CHAR 2025**), at **University of Mauritius**, Mauritius on 1st-5th Sept., 2026.

8. **Dr. Pankaj Biswas**, Asst. Prof. SoP, delivered a distinguished **Plenary Lecture** at the **JK Science Congress 2025**, hosted by PSPS Government College for **Women, Gandhi Nagar, Jammu**, in collaboration with the JKSTIC on 20–21 November 2025.

9. **Dr. S. K. Wanchoo**, Prof. SoP, delivered an **invited talk** and **chaired a session** in National Conference on Advances in Applied Physical Sciences-2025 at **Dept. of Physics, University of Jammu** during 4-6, Dec., 2025.

10. **Dr. Ram Prakash**, Assoc. Prof. SoP, delivered an **invited talk** in National Conference on Advances in Applied Physical Sciences-2025 at **Dept. of Physics, University of Jammu** during 4-6, Dec., 2025.

11. **Dr. Jitendra Sharma,** Assoc. Prof., SoP attended **IIM ATM 2025 & NMA 79th** annual meet and international conference on **Advanced Materials and Critical Materials for Energy Transitions** at IIT Hyderabad on 4-6 Dec., 2025.

12. **Dr. Pankaj Biswas**, Asst. Prof. SoP, was conferred the **Mentor of the Year Award**, a prestigious national recognition by **IIT Bombay** for his exemplary dedication and outstanding mentorship, which have had a significant and positive impact on the academic growth and contributions of student participants associated with the FOSSEE Project, an initiative supported by the Ministry of Education, GoI.

13. **Dr. Anupam K. Sharma** gave an **oral presentation** at "International Conference ICAQNS-2025 organized by **Manipal University Jaipur**, Jaipur on 11-12 September 2025.

Dr. Yugal Khajuria	Dr. S. K. Wanchoo	Dr. Vinod V. Tyagi
Professor	Professor	Associate Professor
Member	Member	Member

Shri Mata Vaishno Devi University

श्री माता वैष्णो देवी विश्वविद्यालय

Kakryal, Katra-182320 (J&K), India

School of Physics

Dr. Anupam K. Sharma
Associate Professor
Member

Dr. Jitendra Sharma
Associate Professor
Member

Dr. Pankaj Biswas
Assistant Professor
Member

Dr. Varun Pandey
Assistant Professor
Member

02/03/2026
Dr. Ram Prakash
Associate Professor & Head, SoP
Chairman

copy of endorsement email is attached herewith
Prof. Prabhakar singh
Professor, Dept. of Physics
IIT BHU
Member Expert (External)

copy of endorsement email is attached herewith
Dr. Ashok Bera
Assoc. Prof., Dept. of Physics
IIT Jammu
Member Expert (External)

Submitted for your kind consideration and necessary action for approval of the same in the forthcoming Academic Council Meeting of the University.

02/03/2026
Dr. Pankaj Biswas
Member Secretary BoS, SoP

02/03/2026
Head, SoP:

To

All members for the information.

Copy to:

1. Dean (AA) for information.
2. Registrar, SMVDU for information & placing of the same before Academic Council.
3. AR, VC office for kind information of the Hon'ble Vice Chancellor.
4. Concerned file.

pankaj biswas <pankaj.biswas@smvdu.ac.in>

Draft Minutes of 14th meeting of BoS of SoP

3 messages

pankaj biswas <pankaj.biswas@smvdu.ac.in> Sun, Mar 1, 2026 at 7:06 PM
To: Department of Physics <dop@smvdu.ac.in>, Ashok Bera <ashok.bera@iitjammu.ac.in>, psingh.app@iitbhu.ac.in
Cc: HoD Physics <hod.physics@smvdu.ac.in>, "Office SoP (Physics)" <office.sop@smvdu.ac.in>

Dear Worthy Board Members,

With reference to the **14th meeting of BoS of SoP** which was held in the SoP conference room (in hybrid mode) on **26.02.2026 at 10:00 a.m. onwards**, PFA the **DRAFT minutes** along with annexures (**in pdf and docx formats**) of the meeting. The Board members are requested to go through the drafted MoM thoroughly and provide their useful suggestions or comments (if any) **on or before 02.03.2026 by 10:30 A.M.**

With Best Regards,

Dr. Pankaj Biswas
Asst. Prof. &
Member Secretary BoS
SoP, SMVDU
(M): 9419113597

5 attachments

- **Annexure-I_MoM 13th BoS.pdf** 1241K
- **DRAFT Minutes of the 14th Meeting of BOS of SoP_26_02_2026.docx** 57K
- **Annexure-III Engg. Phy Lab_revised.doc** 38K
- **Re-Constitution of BoS of SoP.pdf** 368K
- **Annexure-II Detailed Syllabi for M.Sc. 1st Year_Revised.docx** 76K

Dr. Prabhakar Singh <psingh.app@iitbhu.ac.in> Mon, Mar 2, 2026 at 12:45 PM
Reply-To: psingh.app@iitbhu.ac.in
To: pankaj biswas <pankaj.biswas@smvdu.ac.in>
Cc: Department of Physics <dop@smvdu.ac.in>, Ashok Bera <ashok.bera@iitjammu.ac.in>, HoD Physics <hod.physics@smvdu.ac.in>, "Office SoP (Physics)" <office.sop@smvdu.ac.in>

Dear Dr. Biswas,
Thanks for sharing the minutes of the meeting along with other documents. I agree with the minutes. Please go ahead.
Best regards,
Prabhakar Singh
[Quoted text hidden]
--
Dr. Prabhakar Singh
Professor (HAG) and Former Head

Department of Physics
Indian Institute of Technology
(Banaras Hindu University)
Varanasi-221005 (India)
Ph.No. +91-542-7165456
Fax No. +91-542-2368428
Mobile No. +91-9451002283
Web Page: https://www.iitbhu.ac.in/dept/phy/people/psinghapp

Ashok Bera <ashok.bera@iitjammu.ac.in>
To: pankaj biswas <pankaj.biswas@smvdu.ac.in>
Cc: Department of Physics <dop@smvdu.ac.in>, HoD Physics <hod.physics@smvdu.ac.in>, "Office SoP (Physics)" <office.sop@smvdu.ac.in>, psingh.app@iitbhu.ac.in

Mon, Mar 2, 2026 at 12:58 PM

Dear Dr. Biswas,

I agree with the shared minutes of the meeting. Please proceed with the same.

With Regards,
Ashok
[Quoted text hidden]
--
Dr. Ashok Bera
Associate Professor, Physics
Indian Institute of Technology, Jammu
Jagti, Nagrota Bypass Road
NH-44, Jammu 181221
Email:- ashok.bera@iitjammu.ac.in
Phone:-+91-1912571062
https://ashokiacs.wixsite.com/iitjmu-mdseh/blank-2

भारतीय प्रौद्योगिकी संस्थान जम्मू
INDIAN INSTITUTE OF TECHNOLOGY JAMMU
विद्यातत्वं सर्वतत्व प्रयोजनम्

Annexure – I

Shri Mata Vaishno Devi University

श्री माता वैष्णो देवी विश्वविद्यालय

Kakryal, Katra-182320 (J&K),
India

Minutes of the 13th Meeting of Board of Studies of SoP

The chair of the meeting extended warm welcome all the members of BoS, particularly esteemed external experts Prof. D. K. Pandya, Former Professor Department of Physics, IIT Delhi and Prof. Geeta Bhatt, University of Delhi, who joined the meeting virtually and took time out of their busy schedules, for deliberating upon and shaping the curriculum development of various programmes and making these robust, relevant and forward-looking. The chair also thanked internal faculty members and external experts Prof. D. K. Pandya and Dr. Vivek Gupta, Professor, Department of Physics, University of Jammu, who attended the one day PG Curriculum Development Workshop held on 16.07.2025, for their valuable inputs to review, refine and redesign UG and PG courses to keep pace with the latest academic and industry trends, emerging technologies, and student needs.

Agenda Item No. 13.1:

To confirm the minutes of the 12th Meeting of BoS, SoP held on 22nd Feb., 2025.

Resolution:

BoS confirmed the minutes of the 12th Meeting of BoS of SoP held in 22nd February, 2025 which were circulated vide Ref. No. SMVDU/SoP/25/647 dated: 27-02-2025 as appended as **Annexure-I**.

Agenda Item No. 13.2:

To consider and approve the course structure of the courses for the semester I to IV applicable for the Two Year Postgraduate (PG) Programme in Physics for batches to be admitted in AY 2025-26 and onwards NEP 2020.

Resolution:

The detailed course structure of Two year Postgraduate (PG) Programme in Physics as per NEP 2020 with

(i) only coursework for 1st year PG and

(ii)only Coursework (Structure 1), Coursework + Research (Structure 2) and Research only (Structure 3) for 2nd year PG

was prepared, strictly in accordance with the **Broad Course Structure** notified by AA wing (attached as **Annexure-II**), after detailed deliberations during the one day **PG Curriculum Development Workshop**. This was also ascertained while designing the course structure that curriculum of 1st year of PG programme may also become aligned with the 4th year of FYUP in respect of courses and their credits. This also resulted in slight changes in positioning and introduction of a few major and minor courses in the structure of a few semesters of FYUP without disturbing the original credit structure. The Board approved the PG Course Structure (All semesters) and the modified FYUP course structure (VI, VII & VIII semesters) and the same is annexed as **Annexure-III** and **Annexure-IV** respectively. These shall be applicable to the students of Integrated B.Sc.-M.Sc. Physics programme of academic sessions 2022-23 & 2023-24 as well as the students for FYUG and PG programmes of 2025-26 & onwards batches. Further, the Board decided to consider the detailed contents of the courses for only

1st year PG programme as per the availability of resources and requirements.

Agenda Item No. 13.3:

To consider and approve the new courses to enrich the basket of the minor courses in Physics to be offered by the school to the other schools for the students of Four Year Undergraduate Programme (FYUP) and Integrated UG-PG programme for AY 2025-26.

Resolution:

The Board approved the augmented baskets of minor courses to be offered under FYUP (Sem-I and Sem-III) and under Integrated B.Sc.-M.Sc. Programme (Sem-V and Sem-VII) in Physics as per NEP 2020 to facilitate the students of the Non-Engg. disciplines to opt for their choices on Samarth Portal during their semester registration for AY 2025-26, which are annexed as **Annexure-V**. Further, the Board decided to consider the detailed contents of the minor courses only for Sem-I and Sem-III of FYUP and Sem-V of Integrated UG-PG Programme as per the availability of resources and requirements.

Agenda Item No. 13.4:

To report the organization of various activities by the school since the 12th BoS meeting.

Resolution:

The Board noted the reported activities and appreciated the efforts put in by various students, faculty and staff members in having organized variety of curricular, co-curricular and extra-curricular activities and encouraged the faculty members to continue with the same passion and enthusiasm.

The School of Physics organized the following activities since the 12th BoS meeting:

1. The school organized One Day Seminar on "SCIENCE FOR EVERYONE" to celebrate National Science Day under University Fest '25 on 28 Feb., 2025 with the following activities:
   a. Physics demonstrations titled "Ignite Your Curiosity: A Science Extravaganza" by Mr. Surinder Manhas from School Education Department.
   b. Invited Talk "On the Vibrational Landscape of 2D Materials: Bridging Fundamental Science and Applications using Raman Spectroscopy" by Prof. Ajay Soni from School of Physical Sciences, IIT Mandi, HP.
2. The school organized a one day Educational Trip for 71 No. B.Sc., M.Sc. and Ph.D. students accompanied by 05 faculty and staff members to visit Baglihar Hydroelectric Power Project on 12th March, 2025 with partial financial liability on the university.
3. The school also organized 4 days Trekking Trip to Triund, McleodGanj, Himachal Pradesh from 30th April to 3rd May, 2025 in which 26 No. 1st and 2nd year M.Sc. students participated along with 02 faculty members without any financial liability of the university. The trekking

trip was held to promote recreation, physical well-being, team bonding, and a bit of mental refreshment for students after their busy academic schedule.

Agenda Item No. 13.5:

To report the successful defense of Ph.D. thesis by research student namely, Ms Neha Lalotra.

Resolution:

The board expressed satisfaction and noted that a student namely, Ms Neha Lalotra (Entry No. 20DPH002) under the supervision of Dr. Kamni Pathania, Associate Professor, SoP, who is on extraordinary leave, has successfully qualified for the award of Ph.D. degree during June, 2025.

Agenda Item No. 13.6:

To consider the modification in the name and course code of a course namely "Summer Internship" applicable to 5th semester students of 2022-23 & 2023-24 batches.

Resolution:

The Board approved offering of the modified name and course code of a 2 credits IAPC course on "**Summer Internship/ Project/ Dissertation**" (course codes(s): PHD 3131/ PHI PR301/ PHD PR301): LTP: 0-0-4) applicable to 5th semester students of 2022-23 & 2023-24 batches of Integrated B.Sc.-M.Sc. Physics Programme.

Agenda Item No. 13.7:

To consider and ratify the modified L-T-P structure of a multidisciplinary course namely "*Elements of Themodynamics*" in 5 year Integrated B.Sc. (Hons.) Physics – M.Sc. Physics programme.

Resolution:

The board noted and approved the change in L-T-P structure of the multidisciplinary course on "*Elements of Themodynamics*" for 5 year Integrated B.Sc. (Hons.) Physics – M.Sc. Physics programme applicable to the students of 2023-24 batch as per the following table:

S. No.	Name of Course	Previous Course Code & L-T-P	New Course Code & L-T-P	Applicable to
1.	Elements of Themodynamics	PHL MU201 (3-0-1) 4 credits	PHL MU201 (3-1-0) 4 credits	Int B.Sc.- M.Sc. Physics (2023-24)

Shri Mata Vaishno Devi University

श्री माता वैष्णो देवी विश्वविद्यालय

Kakryal, Katra-182320 (J&K).
India

Agenda Item No. 13.8:

To consider and ratify the course codes of the courses for the 5th semester of 5 year Integrated B.Sc. (Hons.) Physics – M.Sc. Physics programme as applicable to students of 2023-24 batch as per the new course coding scheme under NEP 2020.

Resolution:

The Board noted the newly assigned course codes to the Major, Minor and IAPC courses for 5th Semester of 5 year Integrated B.Sc. (Hons.) Physics – M.Sc. Physics programme as applicable to students of 2023-24 batch under NEP 2020. This is attached as **Annexure-VI** for kind information of the board members.

Dr. Yugal Khajuria
Professor
Member

Dr. S. K. Wanchoo
Associate Professor
Member

(on leave)
Dr. Vineet V. Tyagi
Associate Professor
Member

Dr. Anupam K. Sharma
Associate Professor
Member

Dr. Jitendra Sharma
Associate Professor
Member

Dr. Pankaj Biswas
Assistant Professor
Member

Dr. Varun Pandey
Assistant Professor
Member

Dr. Ram Prakash
Associate Professor & Head, SoP
Chairman

Prof. Geeta Bhatt
Director, NCWEB
University of Delhi
Member Expert (External)

Prof. D. K. Pandya
Former Professor of Physics, IIT Delhi
Member Expert (External)

Submitted for your kind consideration and necessary action for approval of the same in the forthcoming Academic Council Meeting of the University.

Shri Mata Vaishno Devi University

श्री माता वैष्णो देवी विश्वविद्यालय

Kakryal, Katra-182320 (J&K).
India

Dt 30-7-25

S.M.V.D.U/SoP/25/111

30/07/2025

Head, SoP

Dr. Pankaj Biswas
Member Secretary BoS, SoP

To

All members for the information.

Copy to:

1. Dean (AA) for information.
2. Registrar, SMVDU for information & placing of the same before Academic Council.
3. AR, VC office for kind information of the Hon'ble Vice Chancellor.
4. Concerned file.

ANNEXURE-II

Detailed Syllabi for M.Sc. Physics as per NEP 2020
Applicable for Batches 2025-26 and Onwards

Semester - I

Major - I

PHL DC601				Quantum Mechanics-II			Course Type		DSC (Theory)	
Session				2025-26			Semester		Odd	
L	T	P	C	Mid-Term Duration	Major Duration	Two Assignments (10 marks each)	Mid-Term Marks	4 Quizzes (5 marks each)	Major Marks	Total Marks
4	0	0	4	1.5 hours	3 hours	20	20	20	40	100

Learning Objectives

This course aims to review the concepts of mechanics learnt at school in a more advanced perspective and progressively builds up new concepts. The students will be able to apply the learnt concepts to many real world problems.

Course Outcomes:

After successful completing this course, the students will be able to

- *To understand the application of Schrodinger equation to three dimensional problems*
- *To understand and Solve simple problems using perturbation theory, Variational Method and WKB*
- *method.*
- *To understand the basics of time dependent perturbation theory and its application to semi-classical theory of atom radiation interaction.*
- *To understand the basic concept of scattering and to get the idea of Born approximation and the method of partial waves.*

Unit-I
Three-Dimensional Energy Eigen Value Problems **[12]**

3D Schrödinger equation, Particle moving in three dimensional box. Particle Moving in a Spherically Symmetric Potential – Radial and Angular Part of Schrodinger Equation - System of Two Interacting Particles -Rigid Rotator – Hydrogen Atom- Radial Equation –Solution to Radial Equation – Energy Eigen Values and Eigen Functions

Unit-II
Approximation methods for stationary states **[8]**

Time independent non-degenerate perturbation theory upto second order. Applications to normal He atom, perturbed harmonic oscillator. Time independent degenerate perturbation theory upto first order. Application of degenerate perturbation theory to stark effect. Variational method, its application to ground state of He atom, W.K.B-approximation, classical turning points, connection formulae, Application to WKB to bound state problem.

Unit-III
Time-dependent perturbation theory **[12]**

Time-Dependent Perturbation Theory: - Transition Probability, Transition Probability for a Constant Perturbation, Transition Probability for a Harmonic Perturbation. Adiabatic and Sudden Approximations: - Adiabatic Approximation, Sudden Approximation. Semi Classical theory of radiations, Expression for transition probability for absorption and induced emission using electric dipole approximation.

Unit-IV

Scattering theory **[10]**

Scattering and Cross Section:- Connecting the Angles in the Lab and CM Frames, Connecting the Lab and CM Cross Sections. Scattering Amplitude of Spinless Particles:- Scattering Amplitude and Differential Cross Section. The Born Approximation:- First Born Approximation, Validity of the First Born Approximation. Partial Wave Analysis for elastic and inelastic scattering, scattering from hard sphere, scattering of identical particles.

Note: The tutorial sessions will comprise of discussing problems from the textbook, assignments and quizzes.

Text Book:

1. Introduction of Quantum Mechanics: D.J. Griffiths.
2. Quantum Mechanics: Theory and Applications by A. K. Ghatak and S. Lokanathan

Suggested Reading(s):

1. Advanced quantum mechanics by B. S. Rajput
2. Quantum Physics by Robert Eisberg and Robert Resnick (John Wiley and sons).

Major - II

PHL DC 603			**An Introduction to Research Methodology**				**Course Type**		**DSC (Theory)**	
Session			**2025-26**				Semester		**Odd**	
L	T	P	C	Mid-Term Duration	Major Duration	Two Assignments (10 marks each)	Mid-Term Marks	4 Quizzes (5 marks each)	Major Marks	Total Marks
4	**0**	**0**	**4**	**1.5 hours**	**3 hours**	**20**	**20**	**20**	**40**	**100**

Learning Objectives

This course aims to provide the concepts for Ph.D. students to understand with research skills and scientific thinking along with design the research problem, execution, analyze, and publish research work ethically. After this course, students will be able to apply the research concepts to many real world problems.

Course Outcomes

After successful completing this course, the students will be able to

- *Research Problem Identification*
  - *Identify research gaps through systematic literature review.*
  - *Formulate clear research problems, objectives, and hypotheses.*
- *Research Design & Method Selection*
  - *Design appropriate quantitative, qualitative, or mixed-method research frameworks.*
  - *Select suitable sampling techniques and data collection methods.*
- *Data Analysis & Interpretation*

- *Apply statistical and analytical tools for data analysis.*

➢ *Research Ethics & Academic Integrity*

- *Demonstrate understanding of research ethics, plagiarism policies, and intellectual property rights.*

UNIT I **[10]**

Philosophy of Science - Subjective thinking versus Objective thinking, Definition and characteristics of research, Types of research: Basic, Applied, Action, Experimental, Interdisciplinary and Translational Research,Identification of research gaps, Literature survey techniques.

UNIT II **[8]**

What scientists actually do; Falsifiability and Reproducibility; Elements of scientific measurement; Logical Reasoning - Inductive logic, Deductive logic, Syllogistic logic;

UNIT III **[10]**

Quantitative Research Methods (Data collection methods (Primary & Secondary data)), Survey design and questionnaire preparation, Experimental design, Reliability and validity
Case studies, Content analysis, Hypothesis testing; Null hypothesis; Statistical methods in hypothesis testing;

UNIT IV **[10]**

Curve fitting, Least Square Fit to a straight line and a polynomial, Simple Scientific graphing and data analysis using software, MS Excel Advanced Analysis, Measurement of a different types graphs, Scientific Writing (Structure of research paper, Abstract writing)

UNIT V **[12]**

Search engines and database; Journal selection criteria, Journal abbreviations, Indices of quality assessment of publications, Research Metrics(Impact factor, h-index, Citation analysis, Scopus, Web of Science databases), Plagiarism & Similarity Check (Plagiarism types, Use of Turnitin/ iThenticate), Research proposal, Report, Thesis; Presentation in Seminar and conference

Text Book:

1. Research Methodology for Natural Sciences, Soumitro Banerjee, IISc Press, 2022.
2. Research Methodology: The Aims, Practices and Ethics of Science, P. Pruzan, Springer, 2016.

Suggested Reading(s):

1. Research Methodology: Methods and Techniques – C.R. Kothari
2. Data Reduction and Error Analysis for the Physical Sciences 3rd Ed. by Philip R Bevington& D Keith Robinson, McGraw – Hill (2003)
3. Research Methodology: – *Dr. Sonal Trivedi*

Major - III

PHP DC605				**Physics Laboratory-I**		Course Type	**DSC (Lab.)**	
Session				**2025-26**		Semester	**Odd**	
L	T	P	C	Major Duration	Lab File (20 marks) + Attendance (10 marks)	Viva	Major Marks	Total Marks
0	**0**	**8**	**4**	**2 hours**	**30**	**30**	**40**	**100**

Learning Objectives

To develop comprehensive experimental proficiency by integrating fundamental principles of physics and analog electronics through precise measurement, circuit design, data analysis, and validation of theoretical concepts in a laboratory environment.

Course Outcomes

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

- *Experimentally verify fundamental laws of wave optics and modern physics by determining key physical constants with precision.*
- *Analyze and interpret experimental data using graphical methods, error estimation, and standard optical instrumentation.*
- *Design and implement basic analog electronic circuits and evaluate their operational characteristics.*
- *Measure and interpret the performance parameters of semiconductor devices and operational amplifier configurations using standard laboratory techniques.*

Choose any 8 experiments (4 from each section) from the list given below:

Section-A: Gen. Physics Experiments

1. To study the temperature dependence of total radiation and hence verify the Stefan's law.
2. To find the wavelength of sodium light using Newton's rings apparatus.
3. To determine Cauchy's constants.
4. To study the Faraday effect and measure the verdant constant of glass rod.
5. To determine the wavelength of spectral lines of hydrogen and hence to determine the value of Rydberg constant.
6. To study the diode diffraction using different types of slits.
7. To find the wavelength of He - Ne laser using Michelson's interferometer.
8. To determine the Planck's constant using photo cell method.

Section-B: Electronics Experiments

1. To design bridge rectifier circuit and study effect of C-filter.
2. To study Zener regulation with fixed input voltage and fixed load.
3. To study common emitter transistor characteristics.
4. To design a common emitter amplifier and draw dc load line curve and measure the voltage gain, input-impedance and output-impedance.
5. To study characteristics of OP-AMP (741) i.e. input offset voltage, input bias current, and input off set current.
6. To design non-inverting and inverting voltage feedback circuit using 741 IC and measure voltage gain.
7. To design voltage summing and differential amplifier using 741 IC.
8. To design the Schmitt trigger circuit and measure UTP and LTP (in volt).
9. To design integrator and differentiator using 741 IC and also waveform conversion from sine to rectangular and rectangular to triangular.

Note: *The list of experiments is not limited to those mentioned above. Faculty members may conduct any experiment in accordance with the syllabi prescribed for various courses in the semester.*

Suggested Reading(s):

1. Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House
2. Practical Physics, G. L. Squires, 2015, 4/e, Cambridge University Press
3. B. Sc Practical Physics, C. L. Arora, 10/e, S. Chand and Co.
4. Basic Electronics A Text-Lab Manual, Zbar, Malvino, Miller, 7/e, McGraw Hill

5. Experiments in Electronics Fundamentals and Electric Circuits Fundamentals, Buchla, David M, 7/e Pearson
6. Electronics Lab Manual Volume I & II, K. A. Navas, 5/e, PHI
7. Inductrial Electronics A Text-Lab Manual, Zbar, Malvino, Miller, 4/e McGraw Hill

Major Elective - I

PHL DE603			Classical Mechanics				Course Type		DSE (Theory)	
Session			2025-26				Semester		Odd	
L	T	P	C	Mid-Term Duration	Major Duration	Two Assignments (10 marks each)	Mid-Term Marks	4 Quizzes (5 marks each)	Major Marks	Total Marks
4	0	0	4	1.5 hours	3 hours	20	20	20	40	100

Learning Objectives

To equip students with a thorough understanding of classical mechanics — from Newtonian dynamics to advanced analytical formulations and relativistic mechanics — enabling them to model, analyze, and solve complex physical systems, and to apply these foundational principles in modern technological fields such as robotics, aerospace engineering, advanced materials research, and high-energy physics, where precise motion analysis and system stability are critical.

Course Outcomes:

After successful completion of the course, students will be able to

- *analyze physical systems using Newtonian mechanics and phase space concepts.*
- *apply variational principles and formulate equations of motion through Lagrangian and Hamiltonian formalisms*
- *utilize conservation laws and symmetries including Noether's theorem to simplify and interpret dynamics*
- *study and predict the behavior of small oscillations and normal modes in coupled systems*
- *extend classical mechanics to relativistic frameworks using four-vector notation for applications in high-speed and high-energy contexts.*

Unit-I

Newton's laws - An overview, Dynamical systems, Phase space dynamics, Stability analysis. **[9]**

Unit-II

Variational principle, Generalized coordinates, Lagrangian and Hamiltonian formalism and equations of motion, Poisson brackets and Canonical transformations. **[15]**

Unit-III

Conservation laws and Cyclic coordinates, Hamilton-Jacobi theory, Symmetry, Invariance and Noether's theorem. **[10]**

Unit-IV

Periodic motion: Formulation of the problem, the eigenvalue equation, small oscillations, frequencies of free vibration, normal modes and normal coordinates. **[12]**

Unit-V

Relativistic kinematics: Four- vector notation, Velocity-energy-momentum-force, Four-vectors for a particle. Relativistic invariance of physical laws, relativistic mass-energy equivalence. **[10]**

Text Book:

1. Classical Mechanics: H Goldstein, 3e Pearson.

Suggested Reading(s):

2. Classical Dynamics of Particles and Systems: Stephen Thornton
3. Classical Mechanics by J C Upadhyay

Major Elective - II

PHL DE607				Nuclear and Particle Physics			Course Type		DSE (Theory)	
Session				2025-26			Semester		Odd	
L	T	P	C	Mid-Term Duration	Major Duration	Two Assignments (10 marks each)	Mid-Term Marks	4 Quizzes (5 marks each)	Major Marks	Total Marks
4	0	0	4	1.5 hours	3 hours	20	20	20	40	100

Learning Objectives

To equip students with a thorough understanding of classical mechanics — from Newtonian dynamics to advanced analytical formulations and relativistic mechanics — enabling them to model, analyze, and solve complex physical systems, and to apply these foundational principles in modern technological fields such as robotics, aerospace engineering, advanced materials research, and high-energy physics, where precise motion analysis and system stability are critical.

Course Outcomes

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

- *analyze physical systems using Newtonian mechanics and phase space concepts.*
- *apply variational principles and formulate equations of motion through Lagrangian and Hamiltonian formalisms*
- *utilize conservation laws and symmetries including Noether's theorem to simplify and interpret dynamics*
- *study and predict the behavior of small oscillations and normal modes in coupled systems*
- *extend classical mechanics to relativistic frameworks using four-vector notation for applications in high-speed and high-energy contexts.*

Unit-I

Basic nuclear properties: size, shape and charge distribution, spin and parity. Binding energy, semi-empirical mass formula, liquid drop model. Nature of the nuclear force, form of nucleon-nucleon potential, charge-independence and charge-symmetry of nuclear forces. **[10]**

Unit-II

Deuteron problem: Simple theory of ground and excited states of deuteron, spin dependence of nuclear forces, nucleon-nucleon scattering, Evidence of shell structure, single-particle shell model, its validity and limitations, collective model, Rotational spectra. **[10]**

Unit-III

Elementary ideas of alpha, beta and gamma decays and their selection rules. Fission and fusion, Bohr-Wheeler theory of nuclear fission, Nuclear reactions, reaction mechanism, endothermic and exothermic reactions, Compound nucleus model, Resonance scattering: Breit-Wigner formula, optical model, direct reactions. **[10]**

Unit-IV

Sensitivity of detector, response of detector, energy resolution of detector, efficiency of detector, dead time detector, ionization chamber, proportional counter, Geiger-Muller counter, scintillation detector, Synchro-cyclotron, betatron, linear accelerator, nuclear chain reaction, general aspects of reactor design, classification of reactors. **[6]**

Unit-V

Classification of fundamental forces, Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.). Fundamental interactions among particles Gellmann-Nishijima formula. Quark model, baryons and mesons. C, P, and T invariance .Application of symmetry arguments to particle reactions. Parity non-conservation in weak interaction. Relativistic kinematics. **[9]**

Text Book(s):

1. Cohen, B.L., Concepts of Nuclear Physics, 2005, Tata McGraw-Hill, New Delhi
2. Kaplan, I., Nuclear Physics, 1998, Narosa Publishing House, New Delhi
3. Griffiths, D., Introduction to Elementary Particles, 1987, John Wiley &SonsHeyde, K., Basic Ideas and Concepts in Nuclear Physics, 2005, Overseas Press, India

Suggested Reading(s):

1. Wong, S.S.M., Introductory Nuclear Physics, 2005, Prentice-Hall, India

Semester - II

Major - 4

PHL DC602			**Electrodynamics and Plasma**				Course Type		**DSC (Theory)**	
Batch			**2022-23**		Session	**2025-26**	Semester		**Even**	
L	T	P	C	Mid-Term Duration	Major Duration	Two Assignments (10 marks each)	Mid-Term Marks	4 Quizzes (5 marks each)	Major Marks	Total Marks
4	**0**	**0**	**4**	**1.5 hours**	**3 hours**	**20**	**20**	**20**	**40**	**100**

Learning Objectives

To develop a comprehensive understanding of classical and relativistic electrodynamics, electromagnetic radiation, and plasma physics, enabling students to analyze wave propagation, radiation mechanisms, field transformations, and plasma behavior using advanced mathematical formulations and physical principles.

Course Outcomes

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

- *Understand and apply the principles governing electromagnetic wave propagation and interaction with matter.*
- *Formulate and analyze electromagnetic fields using potential theory and gauge concepts.*
- *Analyze the generation and characteristics of electromagnetic radiation from accelerated charges.*
- *Apply relativistic principles to the formulation and analysis of electromagnetic phenomena.*
- *Understand and analyze plasma behavior and its applications in physical and technological systems.*

Unit-I

Review of Electromagnetic Waves **[12]**

Maxwell's Equations, Monochromatic Plane Waves in Non-conducting Media, Polarization, Energy Flux in a Plane Wave, Radiation Pressure and Momentum, Electromagnetic Waves in Bounded Media, Boundary Conditions for E and B, Reflection and Refraction of Plane Waves at a Plane Interface (Normal and Oblique Incidence), Plane Waves in a Conducting Medium, Skin Depth

Unit-II

Electromagnetic Potentials and Radiation **[15]**

The Potential Formulation, Gauge Transformations, Coulomb Gauge and Lorentz Gauge, Retarded Potentials, Lienard-Wiechert Potentials, The Fields of a Moving Point Charge, Electric Dipole Radiation, Magnetic Dipole Radiation, Radiation from an Arbitrary Source, Power Radiated by a Point Charge, Radiation Reaction, Physical Basis of Radiation Reaction

Unit III

Relativistic Electrodynamics **[12]**

Magnetism as a Relativistic Phenomenon, Transformation of the Fields, The Electromagnetic Field Tensor, Electrodynamics in Tensor Notation, Relativistic Potentials, Field due to a Point Charge in Uniform Motion, Lagrangian Formulation of the Motion of a Charged, Particle in an Electromagnetic Field, Radiation from Relativistic Particles

Unit IV

Plasma – An Introduction **[9]**

Occurrence of Plasmas in Nature, Definition of Plasma, Concept of Temperature, Debye Shielding, Plasma Parameters, Criteria for Plasmas, Applications of Plasma Physics

Unit V

Properties and Collective Dynamics of Plasmas **[12]**

Quasi-neutrality of a Plasma, Plasma Behaviour in Magnetic Field, Plasma as a Conducting—Fluid-Magnetohydrodynamics, Magnetic Confinement-Pinch Effect, Instabilities, Plasma Waves, Reflection from a Plasma (Ionosphere)

Text Book(s):

1. D.J. Griffiths - Introduction to Electrodynamics, 3rd Ed.
2. B.B. Laud – Electromagnetics, 3rd Ed.
3. F.F. Chen- Introduction to Plasma Physics, 3rd Ed.

Reference book(s):

1. J.D. Jackson - Classical Electrodynamics, 3rd Ed.
2. J.A. Bittencourt – Fundamentals of Plasma Physics, 4th Ed.

Major - V

PHL DC604	Electrical, Optical and Magnetic Properties of Materials			Course Type	DSC (Theory)
Batch	2022-23	Session	2025-26	Semester	Even

L	T	P	C	Mid-Term Duration	Major Duration	Two Assignments (10 marks each)	Mid-Term Marks	4 Quizzes (5 marks each)	Major Marks	Total Marks
4	**0**	**0**	**4**	**1.5 hours**	**3 hours**	**20**	**20**	**20**	**40**	**100**

Learning Objectives

This course aims to provide students with a fundamental understanding of how the internal electronic structure and bonding of materials determine their electrical, magnetic, and optical properties, enabling them to select and design materials for specific engineering applications

Course Outcomes:

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

- *Analyze the fundamental mechanisms of electrical conduction in solids by applying Ohm's Law and Energy Band Theory to distinguish between metals, semiconductors, and insulators based on their atomic bonding and electron mobility.*
- *Evaluate the different types of magnetic behavior—including diamagnetism, ferromagnetism, and ferrimagnetism—and assess how temperature, magnetic domains, and anisotropy influence the performance of soft and hard magnetic materials*
- *Explain the interaction of electromagnetic radiation with solid matter to determine how refraction, reflection, and absorption dictate the optical characteristics (such as color and opacity) of metals, ceramics, and polymers.*
- *Design engineering solutions by selecting appropriate materials for electronic and photonic devices, utilizing principles of semiconduction, the Hall Effect, piezoelectricity, and the functional properties of LEDs and lasers.*

Unit-I
Electrical Properties **[12]**

Introduction - Electrical Conduction, Ohm's Law, Electrical Conductivity, Electronic and Ionic Conduction, Energy Band Structures in Solids, Conduction in Terms of Band and Atomic Bonding Models, Electron Mobility, Electrical Resistivity of Metals, Electrical Characteristics of Commercial Alloys

Unit-II
Magnetic Properties **[14]**

Introduction - Basic Concepts, Diamagnetism and Paramagnetism, Ferromagnetism, Anti-ferromagnetism and Ferrimagnetism, the Influence of Temperature on Magnetic Behavior, Domains and Hysteresis, Magnetic Anisotropy, Soft Magnetic Materials, Superconductivity

Unit-III
Optical Properties **[14]**

Introduction – Basic Concepts, Electromagnetic Radiation, Light Interactions with Solids, Atomic and Electronic Interactions, Optical Properties of Metals, Optical properties of non-metals, Refraction, Reflection, Absorption, Transmission, Colour, Opacity and Translucency inInsulators. Electrical Conduction in Ionic Ceramics and in Polymers - Conduction in Ionic Materials, Electrical Properties of Polymers,

Unit-IV
Applications **[14]**

Materials of Importance—Aluminum Electrical Wires, Intrinsic Semiconduction, Extrinsic Semiconduction, The Temperature Dependence of Carrier Concentration, Factors That Affect CarrierMobility, The Hall Effect,

Semiconductor Devices, Dielectric Behavior – Capacitance, Field Vectors and Polarization, Types of Polarization, Frequency Dependence of the Dielectric Constant, Dielectric Strength, Dielectric Materials, Other Electrical Characteristics of Materials - Ferroelectricity, Piezoelectricity; Luminescence, Materials of Importance—Light-Emitting, Diodes, photoconductivity, and Lasers; Materials of Importance: An Iron–Silicon Alloy That Is Used in Transformer Cores, Hard Magnetic Materials Magnetic Storage

Text Book(s):

1. Materials Science and Engineering – An Introduction, William D. Callister, Jr. and David R. Rethwisch, 8thEd., McGraw Hill Education, 2017

Suggested Reading(s):

1. Materials Science and Engineering: A First Course, V Raghavan, 6th Ed., PHI, 2015

Major - VI

PHP DC605			**Physics Laboratory-II**			Course Type	**DSC (Lab.)**	
Session			**2025-26**			Semester	**Even**	
L	T	P	C	Major Duration	Lab File (20 marks) + Attendance (10 marks)	Viva	Major Marks	Total Marks
0	**0**	**8**	**4**	**2 hours**	**30**	**30**	**40**	**100**

Learning Objectives

To develop comprehensive experimental proficiency in core physics and electronics by designing, performing, and analyzing experiments to determine fundamental physical parameters, verify physical laws, and implement basic analog, digital, and microprocessor-based systems.

Course Outcomes

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

- *Conduct core experiments in semiconductor, magnetic, optical, dielectric, and thermal physics with systematic data analysis.*
- *Determine key physical parameters and validate fundamental laws through precise measurement and interpretation.*
- *Design and verify analog and digital circuits including waveform generators, filters, converters, and regulated power supplies.*
- *Implement basic 8085 microprocessor programming and interfacing for simple digital applications.*

Choose any 8 experiments (4 from each section) from the list given below:

Section-A: Gen. Physics Experiments

1. To find the energy band gap of pn junction diode apparatus.
2. To determine the di-electric constant of PZT material with temperature variation and find its Curie temperature value.
3. To determine the specific heat of various solids by the method of heat transfer.
4. To plot the BH curve for the sample coil.
5. To measure field strength B along the circular coils and verify the Biot-Savart's law.
6. To study Zeeman effect
7. To observe the rotation of the plane of polarization of monochromatic light by given sugar solution and determine the specific rotation of sugar using a polarimeter.
8. To study the Hall-effect and to calculate the Hall coefficient and charge carrier Concentration of a given sample.

Section-B: Electronics Experiments

1. To generate different waveforms (sine, square & triangular) using 741 IC.
2. To design 4-bit weighted resistor and R-2R ladder DACs.
3. To study D/A and A/D converter ICs.
4. To design and verify the truth table for half adder and full adder logic circuits.
5. To design second order low pass and high pass active filter circuits and to study their frequency responses.
6. To design a regulated power supply using LM 317 IC and to study its voltage and current regulation characteristics.
7. To study of multiplexer and de-multiplexer.
8. To study serial in, serial out, parallel in and parallel out operations in shift registers.
9. To study 8085 Microprocessor and to execute simple programs.
10. To study SID and SOD functions using 8085.

Note: *The list of experiments is not limited to those mentioned above. Faculty members may conduct any experiment in accordance with the syllabi prescribed for various courses in the semester.*

Suggested Reading(s):

1. Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House
2. Practical Physics, G. L. Squires, 2015, 4/e, Cambridge University Press
3. B. Sc Practical Physics, C. L. Arora, 10/e, S. Chand and Co.
4. Basic Electronics A Text-Lab Manual, Zbar, Malvino, Miller, 7/e, McGraw Hill
5. Experiments in Electronics Fundamentals and Electric Circuits Fundamentals, Buchla, David M, 7/e Pearson
6. Electronics Lab Manual Volume I & II, K. A. Navas, 5/e, PHI
7. Inductrial Electronics A Text-Lab Manual, Zbar, Malvino, Miller, 4/e McGraw Hill

Major Elective – III

PHL DE602				**Solar Photovoltaics: Principles and Applications**			Course Type		**DSE (Theory)**	
Session				**2025-26**			Semester		**Even**	
L	T	P	C	Mid-Term Duration	Major Duration	Two Assignments (10 marks each)	Mid-Term Marks	4 Quizzes (5 marks each)	Major Marks	Total Marks
4	**0**	**0**	**4**	**1.5 hours**	**3 hours**	**20**	**20**	**20**	**40**	**100**

Learning Objectives

This course aims to provide the concepts of solar photovoltaic and Applications learnt at school in a more advanced perspective and progressively builds up new concepts. The students will be able to apply the learnt concepts to many realworld problems.

Course Outcomes:

After completing this course, the students will be able to

1. *Knowledge of solar energy and radiation components*
2. *Fundamentals of P–N Junction Theory, Energy band diagram, Efficiency calculation for Photovoltaic System*

3. *Learn different materials for solar cells, monocrystalline silicon, polycrystalline silicon, thin-film (CdTe, a-Si, CIGS) and others*
4. *Mathematical calculations for PV System Types (Standalone systems, Grid-connected systems, Hybrid systems)*
5. *Learn different types applications for solar PV i.e. rooftop solar systems, solar water pumping, solar microgrids and refrigeration and air-conditioning system*

Unit I

Solar Energy Basics, Solar constant and extraterrestrial radiation, Solar spectrum, Solar radiation components (beam, diffuse, global), Solar geometry (declination, hour angle, zenith angle, etc), Solar Collectors, Energy bands in solids, Intrinsic and extrinsic semiconductors, Fermi level, Charge Carrier, Drift Velocity, Mobility of carriers, Drift and diffusion velocity, diffuse current

Unit II

P–N Junction Theory (Formation of P–N junction, Depletion region, Energy band diagram), Photovoltaic effect, Generation and recombination of carriers, Short Circuit Current (Isc), Open Circuit Voltage (Voc), Fill Factor (FF), I-V Characteristics, Maximum Power Point (MPP), Efficiency calculation, Effect of Temperature on Solar Cells, Advantages of SPV

Unit III

Materials for Solar Cells, Monocrystalline silicon, Polycrystalline silicon, Thin-film (CdTe, a-Si, CIGS), Emerging technologies (Perovskite, Bifacial cells), Cell to module configuration, Series and parallel connections, Bypass and blocking diodes, Module rating (Wp), Batteries (Lead-acid, Li-ion) for Solar PV

Unit IV

PV System Types (Standalone systems, Grid-connected systems, Hybrid systems), Applications of Solar PV, Rooftop solar systems, Solar water pumping, Solar street lighting, Utility-scale Solar Plants, Solar microgrids, Solar PV based refrigeration and air-conditioning system

Text Book(s):

1. Solar Photovoltaics: Fundamentals, Technologies and Applications by Chetan Singh Solanki, PHI Publisher
2. Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers by Chetan Singh Solanki, PHI Publisher

Suggested Reading(s):

3. Solar Energy: Fundamentals, Design, Modelling and Application, G. N. Tiwari, Narosa Publisher
4. Solid State Electronics Devices, B.G. Streatman

Major Elective – IV

PHL DE604				**Fibre Optics**			Course Type		**DSE (Theory)**	
Session				**2025-26**			Semester		**Even**	
L	T	P	C	Mid-Term Duration	Major Duration	Two Assignments (10 marks each)	Mid-Term Marks	4 Quizzes (5 marks each)	Major Marks	Total Marks
4	**0**	**0**	**4**	**1.5 hours**	**3 hours**	**20**	**20**	**20**	**40**	**100**

Course Outcomes:

After completing this course, the students will be able to

1. *Analyze light propagation in optical fibers using Ray Optics to derive and calculate critical parameters such as Acceptance Angle, Numerical Aperture, and launching conditions.*
2. *Evaluate the behavior of guided modes in cylindrical waveguides by solving Maxwell's equations and determining characteristic parameters like the V-number and cutoff wavelength.*
3. *Quantify and compare signal impairments, including attenuation mechanisms (absorption, scattering) and dispersion types (modal, material, waveguide), to estimate total system bandwidth.*
4. *Compare the physical principles and performance characteristics of optical sources (LEDs vs. Lasers) and photodetectors (PIN vs. APD) to select appropriate components for specific link requirements.*
5. *Design a complete fiber optic communication link by performing power budget and rise-time budget calculations to ensure reliable digital and analog transmission.*
6. *Assess the impact of nonlinear effects (SPM, XPM, FWM) and the utility of specialty fibers (Photonic Crystal Fibers) and amplifiers (EDFA) in modern high-capacity and industrial applications.*

UNIT I Fundamentals & Ray Optics **[08]**

Course overview, scope, applications, evaluation, History of fiber optics, milestones, modern relevance, Structure of optical fiber (core, cladding, coatings), Refractive index profiles (step vs graded). Total internal reflection, Acceptance angle & Numerical Aperture (NA derivation), Launching conditions & power coupling, Limitations of ray optics approach.

UNIT II Wave Optics & Modes **[12]**

Maxwell's equations in dielectrics, Wave equation in cylindrical waveguides, Boundary conditions & guided modes, LP modes: physical interpretation, Normalized frequency (V-number): derivation, Single-mode vs multimode operation, Cutoff wavelength, general treatment of waveguides, difference between transmission line and waveguide, modes of rectangular waveguides, field component calculations, derivation of various characteristic parameters of waveguides, Mode degeneracy & polarization.

UNIT III Losses & Dispersion **[10]**

Attenuation mechanisms overview, Absorption losses (intrinsic & extrinsic), Rayleigh, scattering (theory & wavelength dependence), Bending losses (macro & micro bending), Measurement of attenuation, Dispersion: concept & pulse broadening, Modal dispersion (derivation), Material dispersion, Waveguide dispersion, Total dispersion & bandwidth calculations.

UNIT IV Sources, Detectors & Systems **[08]**

Optical sources: LEDs (physics & characteristics), Semiconductor lasers (rate equations – qualitative), Laser vs LED comparison, Photodetectors: PIN photodiode, Avalanche photodiode (APD), Noise in optical receivers, Fiber optic communication system, Power budget & system design.

UNIT V Nonlinearity, Special Fibers & Applications **[10]**

Origin of optical nonlinearity, Kerr effect & nonlinear refractive index, Self-phase modulation (SPM), Cross-phase modulation (XPM), Four-wave mixing (FWM) Stimulated Raman scattering, Stimulated Brillouin scattering, Impact of nonlinearity on communication systems, Photonic crystal fibers, Fiber amplifiers (EDFA), Fiber lasers, Fiber optic sensors, Biomedical, defense & industrial applications, Recent advances, research trends.

Text Book(s):

1. Optics, A. Ghatak, 8/e.

Suggested reading(s):

1. Optical Fiber Communications: Principles and Practice by John M. Senior, 3rd Edition, Pearson Education.
2. Fiber-Optic Communication Systems by Govind P. Agrawal, 5/e (An Indian Adaptation), Wiley India.
3. Optical Fiber Communications by Gerd Keiser, 5th Edition (Special Indian Edition), McGraw Hill Education
4. Fiber Optics and Optoelectronics by R.P. Khare, 1st Edition, Oxford University Press.

Annexure-III

PHP BS101			Engineering Physics Lab			Course Type	Lab.	
Session			2025-26			Semester	Odd/ Even	
L	T	P	C	Major Duration	Lab File (20 marks) + Attendance (10 marks)	Viva	Major Marks	Total Marks
0	0	8	4	2 hours	30	30	40	100

Learning Objectives

To develop the ability to experimentally investigate and validate fundamental principles of optics, electromagnetism, quantum physics, and material science through precise measurements, data analysis, and interpretation of physical phenomena.

Course Outcomes

After successful completion of this course, students shall be able to:

CO1: *Apply principles of optics to determine refractive index, wavelength, dispersive power, and analyze interference and diffraction phenomena.*

CO2: *Validate fundamental laws of classical and modern physics through experimental verification and quantitative analysis.*

CO3: *Evaluate electrical, magnetic, and semiconductor properties of materials using standard measurement techniques.*

CO4: *Determine fundamental physical constants and analyze experimental data using graphical methods and error estimation techniques.*

All the students are required to do any six experiments from the list given below:

1. To find the refractive index of the material of given prism using a spectrometer.
2. To study the Newton's interference rings and to determine the wavelength of sodium light.
3. To determine the wavelength of sodium light using a plane diffraction grating.
4. To determine the frequency of A.C. mains with a sonometer using non- magnetic wire.
5. To verify Stefan's law by estimating the temperature of a torch bulb filament from resistance measurement.
6. To study the dependence of refractive index of the material of the prism on the wavelength of light; and hence (1) to determine the dispersive power of the material of prism; (2) verify the Cauchy relationship $\mu = a + b/\lambda^2$, and estimate the values of a & b (3) plot a graph of $d\mu/d\lambda$ versus λ.
7. To determine the band gap by measuring the resistance of a thermistor at different temperatures.
8. To determine the value of Planck's constant by studying the variation of stopping potential with frequency using the photoelectric effect and to verify the linear relationship predicted by quantum theory.
9. To verify Biot–Savart's law by measuring the magnetic field produced by a current-carrying conductor and to study the dependence of magnetic field strength on current and distance.

10. To demonstrate the generation and detection of electromagnetic waves and thereby experimentally verify Maxwell's electromagnetic theory of radiation.
11. To determine the electrical resistivity (or conductivity) of a semiconductor material using the four-probe method and to study its temperature dependence.
12. To study the magnetic field produced by a pair of Helmholtz coils and to determine the horizontal component of the Earth's magnetic field.
13. To verify Faraday's law of electromagnetic induction by observing the induced emf in a coil due to a changing magnetic flux and to study its dependence on the rate of change of flux.

Suggested Book(s):

1. Practical Physics by G L Squires Cambridge University Press.
2. Advanced Practical Physics for Students by Worsnop and Flint.
3. B. Sc Practical Physics by C. L. Arora.
4. Practical Physics by R K Shukla.
5. B.Sc Practical Physics by Harnam Singh.
6. An Advanced Course in Practical Physics by D. Chattopadhyay, P.C. Rakshit.
7. A Text Book of Practical Physics, S.K. Ghosh, 2015, New Central Book Agency.

Shri Mata Vaishno Devi University
श्री माता वैष्णो देवी विश्वविद्यालय
Kakryal, Katra-182320 (J&K), India
School of Physics

Agenda for the 14th Meeting of Board of Studies of SoP (Hybrid Mode)

Date: 26/02/2026
Time: 10:00 a.m. onwards
Venue: Conference Hall, SoP

Shri Mata Vaishno Devi University

श्री माता वैष्णो देवी विश्वविद्यालय

Kakryal, Katra-182320 (J&K), India

School of Physics

Detailed Agenda

Agenda Item No. 14.1:

To confirm the Minutes of the 13th Meeting of the Board of Studies, School of Physics, held on 17th July, 2025.

The minutes of the 13th Meeting of BoS of SoP held in 17th July, 2025 vide Ref. No. SMVDU/SoP/25/111 dated: 30-07-2025 were circulated among all the board members for their kind information and were endorsed by all the worthy members. Since no comments/ observations/ suggestions were received in this regard, accordingly the board may kindly consider and confirm the same. Copy of the minutes is appended as **Annexure-I**.

Agenda Item No. 14.2:

To consider and approve the detailed syllabi and course contents of Ist year of the Two-Year Postgraduate (PG) Programme in Physics, applicable to students admitted from Academic Year 2025–26 and onwards under the NEP 2020 framework.

Background: In its 13th meeting, the Board of Studies approved the overall course structure for Semesters I–IV of the Two-Year PG Programme in Physics for batches admitted from AY 2025–26 onwards in alignment with NEP 2020. As per the approved framework, the **first year comprises coursework only**, while the **second year offers three pathways**: (i) **Coursework only**, (ii) **Coursework with Research**, and (iii) **Research only**. The structure was thoughtfully designed to align the **first-year PG curriculum** with the **fourth year of the Four-Year Undergraduate Programme (FYUP)** in terms of courses and credit distribution. At that stage, detailed syllabi were approved only for the first year, based on prevailing requirements and available resources.

Subsequently, the draft detailed syllabi and course contents for Semester–III have been prepared and are now placed before the Board for its consideration and approval. The same is attached as **Annexure-II**.

Agenda Item No. 14.3:

To consider and approve the revised list of experiments for the course Engineering Physics Lab (PHP BS101), consequent upon the inclusion of new experiments, applicable to B.Tech. students to be admitted from Academic Year 2026–27 onwards.

Background: Over time, a need has been felt to strengthen the integration of theory and practice in the Engineering Physics course offered by the School of Physics to various Engineering disciplines. Accordingly, the existing list of experiments for **Engineering Physics Lab (PHP BS101)** has been revised through the inclusion of new experiments designed to reinforce core theoretical concepts via hands-on experimentation, systematic data analysis, and critical interpretation, thereby enhancing conceptual understanding and

analytical proficiency.

A draft of the revised list of experiments has been prepared and is placed before the Board for its consideration and approval and is annexed as **Annexure-III.**

Agenda Item No. 14.4:

To discuss thoroughly the proposed course structure for the Minor Programme in Quantum Technology for B.Tech. Computer Science students to be admitted from Academic Year 2026–27 onwards.

Background: The All India Council for Technical Education (AICTE), in collaboration with the Department of Science and Technology (DST) under the National Quantum Mission, has introduced **an undergraduate Minor Programme in Quantum Technologies.** Launched in December 2024, the programme is designed for B.Tech. students across disciplines and comprises a minimum of 18 credits spread over at least six courses, integrating strong theoretical foundations with hands-on laboratory components.

In accordance with the guidance of the Hon'ble Vice-Chancellor, it is proposed that the School initially offer this Minor Programme to B.Tech. Computer Science students. Based on its outcomes and feasibility, the programme may subsequently be extended to other engineering schools.

The draft course structure of the proposed programme is placed before the Board for discussion ans is attached as **Annexure-IV**. The programme is intended to be implemented from the Academic Year 2026–27 onwards, and a detailed deliberation on its structure and academic framework would be highly valuable.

Agenda Item No. 14.5:
To consider any other item(s) with the permission of the Chair.

श्री माता वैष्णो देवी विश्वविद्यालय

SHRI MATA VAISHNO DEVI UNIVERSITY

Kakryal, Katra – 182320 (J&K)

(A State University Recognized u/s 2(f) & 12(B) of UGC Act, 1956

No. SMVDU/AA/26/2105 Dated: 20.01.2026

NOTIFICATION

Subject: Re-Constitution of Board of Studies of School of Physics

With reference to proposal of Dr. Ram Prakash, Head, SoP forwarded by Dean, FoS and as approved by the Competent Authority, Sanction is hereby accorded for the re-constitution of the Board of Studies of School of Physics as under:

1.	Head, School of Physics	Chairman
2.	All faculty members of School of Physics	Members
3.	Prof. Prabhakar Singh, Professor, Department of Physics, Indian Institute of Technology (BHU), Varanasi, Uttar Pradesh	Member Expert
4.	Dr. Ashok Bera, Associate Professor, Department of Physics, Indian Institute of Technology Jammu	Member Expert

The Head concerned may nominate one of the Faculty Member of the School as Member Secretary of BoS of SoP.

All the Member Experts shall hold the office for a period of three years w.e.f 22nd December, 2025.

The Member Experts shall be entitled TA as admissible under rules. Besides, they shall also be entitled for Honorarium (as per rules), providing of Local Transport facility and Local Hospitality in the University Guest House.

Further, presence of the Chairman along with 50% of the members of the committee shall form quorum. The recommendations of BoS shall be reviewed by a committee chaired by the Dean of concerned Faculty with Heads of the various schools of the Faculty as members.

The matter shall be placed before the Academic Council in its next meeting for confirmation/ratification

This issues with the approval of the Competent Authority.

Registrar

Copy to:

1. Dean, FoS, for information.
2. Head, SoP, for information and further n.a. with respect to conveying the same to Member Experts (External) regarding their nomination to the BoS of SoP.
3. Finance Officer, for information.
4. Concerned _____ Member BoS of SoP, for information.
5. AR (VC office) for the information of HVC.
6. Concerned file.