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

SMVDU/SoP/20/ Dated:

Minutes of the 7th meeting of Board of Studies (BoS) of School of Physics (SoP), SMVDU

The 7th meeting of board of Studies (BoS) of School of Physics (SoP), SMVDU was held on 5th October, 2020 via Online Mode (Google meet) at 11:30 AM, while keeping the social distancing norms in mind under the prevailing COVID-19 crisis. In the meeting, some academic matters related to newly launched Integrated B.Sc. (Hons.) Physics-M.Sc. Physics program offered by the School of Physics were discussed. Following members were present:

S. No.	Name/ BoS Participants	Affiliation
1.	Prof. Ashok K. Sharma	Professor & Head, SoP Chairman (Ex-Officio)
2.	Prof. D. K. Pandya	Visiting Professor, Department of Physics IIT Jammu (Former Professor of Physics, IIT Delhi) External Member Expert
3.	Prof.Saumitra Mukherjee	Professor (of Physics) in School of Environmental Sciences, JNU, New Delhi External Member Expert
4.	Dr .S.K. Wanchoo	Associate Professor, SoP
5.	Dr.YugalKhajuria	Associate Professor, SoP
6.	Dr.Jitendra Sharma	Assistant Professor, SoP
7.	Dr.Kamni	Assistant Professor, SoP
8.	Dr.Vivek K. Singh	Assistant Professor, SoP
9.	Dr. Ram Prakash	Assistant Professor, SoP
10.	Dr. Pankaj Biswas	Assistant Professor, SoP Member Secretary, BoS of SoP

In the beginning of the meeting, Prof. A.K. Sharma, Chairman BoS & Head School of Physics welcomed the members of BoS particularly Prof. Pandya and Prof. Mukherjee for sparing their valuable time out of their busy schedule to attend the meeting. Subsequently, Dr. Pankaj Biswas, member secretary, BoS, apprised the members about the agenda items to be discussed in the meeting.

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It was informed to the BoS members that the status of compliance of the decisions taken in the previous (6th and emergency) BoS meetings shall be placed before the next BoS meeting of SoP.

Agenda Item No. 1:

To approve the syllabi corresponding to the modified course structure for the 5 year Integrated B.Sc. (Hons.) Physics - M.Sc. Physics program:

Background: The BoS of the School, at its 6th meeting held on 29th Jan, 2020, had approved the course structure of the Int. B.Sc. (Hons.) Physics-M.Sc. Physics program, attached as Annexure-I, with the total number, of credits limited to 200. Later the said structure was placed by Head, SoP before the committee of various school heads under the chairmanship of Dean FoS (copy of invitation is attached as Annexure-II). The Head, SoP was asked to introduce option for lateral entry at the M.Sc. Physics level. Consequently, several changes in the credit and course structure of the program took place (attached as Annexure-III). The detailed syllabi based on the modified course structure had also been worked out and was presented before the BoS for kind consideration and approval.

The external members (as experts) of BoS emphasized on several points concerning the program. The highlights of the points are presented below:

(i) The Integrated B.Sc. (Hons.) Physics - M.Sc. Physics program should be balanced blend of courses in core, interdisciplinary, subsidiary, applied, interpersonal skill areas and electives (discipline specific as well as open across the disciplines). It should have hand-on experience and projects based research components for the students' right from the beginning.

(ii) The experts at the outset raised objection over the total number of credits for the program and said that they are not in favour of the number of credits to be increased beyond 200. They identified that the modified credit structure of the Integrated. B.Sc.-M.Sc. Physics program does not agree with the existing current structure of credits anywhere in the country. They found no merit to make a difference from the structure that board had accepted in the 6th BoS meeting after quite lengthy deliberations.

(iii) The BoS member experts urged that whatever credits the board had agreed upon in its 6th BoS were already on higher side and there is no reason that the board should seek to go beyond 200. Prof. Pandya pointed out that the New Education Policy (NEP) mandates a rather lower credits to make room for time out side class room for students to assimilate the contents taught and do some independent study. Prof. Mukherjee emphasized that the total credits for a program should be decided by the School on academic merit and that too depends on the expertise available with it.

(iv) The experts submitted that the students should not be overloaded with 200 or more credits and the proposed credits are really on upper limit and it actually should go down to provide breathing space to a student.

(v) The other BoS members were also in favour of limiting the total credits to 200 or even less for this program and opined that it would otherwise overburden the students. Annexure III as given in agenda with total 228 credits is therefore not approved by BoS unanimously.

(vi) The experts also suggested that the Physics Laboratory for this program shall be a separate component and not as part of the theory course so that the students give due weightage and seriousness to the Lab and do not pass the Lab course without any serious efforts to the hands-on-experience. In the present submission, only the subsidiary courses offered by SoP for other departments/ disciplines have L-T-P as 3-0-2. ***Even for the Physics subsidiary course it was advised to have theory course of 3-0-0 and Lab course of 0-0-2 as independent courses.***

(vii) The BoS members decided that once the credit and the course structures of the said program are frozen, only then the detailed syllabi can be considered for recommendation.

(viii) Finally, after due deliberations from the BoS members, the following changes were incorporated into the course structure (as approved in 6th BoS) of Integrated B.Sc. (Hons.) Physics-M.Sc. Physics program (attached as Annexure-IV). This was done to accommodate the offering of the subsidiary courses as per their scheduling in the respective Departments, to the extent possible and without compromising the teaching flow of main/ core subjects.

a. The subsidiary Physics courses offered by the School for other departments can be different from its core courses. But it is better to keep it same. Otherwise this will increase the teaching load of the School and availability of faculty for teaching them may become compromised.

b. A few compulsory interdisciplinary and subsidiary courses were switched according to their availability for students during odd/ even semester.

c. Some new Program Electives (PE) have been introduced.

Agenda Item No. 2:

To recommend the proposed budgetary requirements of Physics laboratory for Integrated B.Sc.(Hons.) Physics-M.Sc. Physics, B.Tech. & M.Sc. Physics Program for approval by the university

The BoS recommended the proposed experiments for developing Ist year Int. B.Sc.(Hons.) Physics-M.Sc. Physics laboratory and upgrading B.Tech. and M.Sc. Physics laboratories (attached as Annexure-V) and suggested that some experiments on measuring fundamental constants in Physics like- velocity of light (c), electronic charge (e) and Planck's constant (h) should be introduced in B.Sc. (Hons.) Physics Lab. They also advised that the experiments should be chosen and designed so that the students should develop the habits of data handling and error analysis while performing them. The BoS further recommended that the proposal can be sent to the university as budgetary requirements for Lab. Development.

Annexure-I

(Course Structure Approved by 6th BoS of SoP)

Credit structure

	Credits Details			%
	Theory + Tutorial + Practical			Credits
	B.Sc.	M.Sc.	B.Sc. + M.Sc.	
I. Core Courses				
Core Courses (Theory) (Total 17 in number)	10 × 3 + 1 × 2 = 32	8 × 3 = 24	21 × 3 + 1 × 2 = 56	28
Core Course (Tutorial) (Total 4 in number)	-	4 × 1 = 4	4 × 1 = 4	2
Core Course (Practical) (Total 13 in number)	7 × 2 + 2 × 1 = 16	6 × 2 = 12	7 × 2 + 2 × 1 + 6 × 2 = 28	14
II. Core Courses Interdisciplinary				
Core Courses (Theory) Interdisciplinary (Total 6 in number)	6 × 3 = 18	-	6 × 3 = 18	09
Core Courses (Practical) Interdisciplinary (Total 5 in number)	5 × 1 = 5	-	5 × 1 = 5	02.5
III. Subsidiary Compulsory Courses				
Subsidiary Course (Theory) (Total 7 in number)	7 × 3 = 21	-	7 × 3 = 21	10.5
Subsidiary Course (Tutorial) (Total 3 in number)	3 × 1 = 3	-	3 × 1 = 3	01.5
Subsidiary Course (Practical) (Total 4 in number)	4 × 1 = 4	-	4 × 1 = 4	2
IV. Elective Courses				
Programme Electives (Theory) (Total 8 in number)	-	6 × 3 = 18	6 × 3 = 18	09
Open Electives (Theory) (Total 4 in number)	2 × 3 = 6	2 × 3 = 6	4 × 3 = 12	06
V. Ability Enhancement Compulsory Courses				
Communication and Comprehension Skills (Theory) (Total 2 in number)	2 × 1 = 2	-	2 × 1 = 2	01
Communication and Comprehension Skills (Practical) (Total 2 in number)	2 × 1 = 2	-	2 × 1 = 2	01
Environmental Sciences and Ethics (Theory) (Total 2 in number)	2 × 2 = 4	-	2 × 2 = 4	02
VI. Dissertation/Project				
Minor Project Part-I & II (Total 2 in number)	3 + 4 = 7	-	3 + 4 = 7	03.5
Project Part-I & II (Total 2 in number)	-	2 × 8 = 16	2 × 8 = 16	08
Total	**120**	**80**	**200**	**100**

Course Structure of B.Sc. (Hons.) Part

Semester I	L-T-P	Credits	Semester II	L-T-P	Credits
Basic Optics #	(3-0-2)	4	Electromagnetics and EM Waves #	(3-0-0)	3
Mechanics	(3-0-0)	3	Circuit Theory	(3-0-2)	4
Chemistry-I	(3-0-2)	4	Chemistry-II (*Polymer Chemistry*)	(3-0-2)	4
Mathematics-I (*Calculus and Diff. Eq.*)	(3-1-0)	4	Mathematics-II (*Linear Algebra*)	(3-1-0)	4
Communication Skills	(1-0-2)	2	Comprehension Skills	(1-0-2)	2
Physics Lab-I (Meteorology, Errors, Curve fitting, Computer based experiments and data analysis)	(0-0-4)	2	Physics Lab-II (Experiments on Electromagnetics, EM waves, Mechanics)	(0-0-4)	2
	(13-1-10)	19		(13-1-10)	19

Semester III	L-T-P	Credits	Semester IV	L-T-P	Credits
Thermal and Statistical Physics #	(3-0-0)	3	Modern Physics #	(3-0-2)	4
Analog Electronics	(3-0-2)	4	Applied Optics & Communication	(3-0-0)	3
Biology-I	(3-0-2)	4	Biology-II	(3-0-2)	4
Mathematics-III	(3-1-0)	4	Biochemistry, Biotechnology and Biophysics	(3-0-0)	3
Programming and Languages	(3-0-2)	4	Data Structure and Algorithm	(3-0-2)	4
Environmental Sciences	(2-0-0)	2	Ethics in Science & Engineering	(2-0-0)	2
Physics Lab-III	(0-0-4)	2	Physics Lab-IV	(0-0-4)	2
	(17-1-10)	23		(17-0-10)	22

Semester V	L-T-P	Credits	Semester VI	L-T-P	Credits
Quantum Mechanics	(3-0-0)	3	Solid State Physics	(3-0-0)	3
Numerical Computation	(2-0-4)	4	Characterization Techniques	(3-0-0)	3
Digital Electronics	(3-0-2)	4	Fundamentals of Materials Science	(3-0-0)	3
Humanities (Open Elective-I)	(3-0-0)	3	Management (Open Elective-II)	(3-0-0)	3
Physics Lab-V	(0-0-4)	2	Physics Lab-VI	(0-0-4)	2
Minor Project Part-I	(0-0-6)	3	Minor Project Part-II	(0-0-8)	4
	(11-0-16)	19		(12-0-12)	18

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Total credits for the B.Sc. degree = 120

#Subsidiary Courses from Physics for other discipline programmes

Sem-I	Physics-I (Basic Optics)
Sem-II	Physics-II (Electromagnetics and EM Waves)
Sem-III	Physics-III (Thermal and Statistical Physics)
Sem-IV	Physics-IV (Modern Physics)

Course Structure M.Sc. Physics* Part

(For B.Sc. Students with minimum academic level of CGPA=7)

Semester VII	L-T-P	Credits	Semester VIII	L-T-P	Credits
Classical Mechanics	(3-1-0)	4	Electrodynamics and Plasma	(3-1-0)	4
Mathematical Physics	(3-1-0)	4	Advanced Quantum Mechanics	(3-1-0)	4
Dielectric, Optical and Magnetic Behaviour of Solids	(3-0-0)	3	Quantum Optics	(3-0-0)	3
Spectroscopy	(3-0-0)	3	Physics of Semiconductor Devices	(3-0-0)	3
Advanced Physics Lab-I	(0-0-12)	6	Advanced Physics Lab-II	(0-0-12)	6
	(12-2-12)	20		(12-2-12)	20
Semester-IX	**L-T-P**	**Credits**	**Semester X**	**L-T-P**	**Credits**
Program Elective-I	(3-0-0)	3	Program Elective-IV	(3-0-0)	3
Program Elective-II	(3-0-0)	3	Program Elective-V	(3-0-0)	3
Program Elective-III	(3-0-0)	3	Program Elective-VI	(3-0-0)	3
Open Elective-III	(3-0-0)	3	Open Elective-IV	(3-0-0)	3
Project Part-I	(0-0-16)	8	Project Part-II	(0-0-16)	8
	(12-0-16)	20		(12-0-16)	20

*** The existing M.Sc. Physics course structure will continue to run as it is.**

Total credits for the five year dual degree M.Sc. Program in Physics: 120 + 80 = 200

List of Physics School Electives

1. Liquid and Polymer Physics
2. Electronic Communication
3. Plasma Physics and Plasma Processing
4. Solid State Electronics

5. Physics of Crystalline Materials
6. Introduction to Photonics & Plasmonics
7. Introduction to Nanoscience and Nanotechnology
8. Introduction to Nanomaterials
9. Electronic Theory of Solids
10. Optical Spectroscopy and Microscopy
11. Thin Films and Vacuum Technology
12. Atomic and Molecular Structures
13. Atmospheric and Space Physics
14. Astronomy and Astrophysics
15. Nuclear and Particle Physics
16. Nuclear Physics: Medicine, Agriculture, Energy and Safety
17. Microprocessors and Microcontrollers
18. Biophysics
19. Seismology
20. Special Topics

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Annexure-II

Copy of Invitation for Meeting of School Heads

SMVDU

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

Fwd: Meeting Related to Integrated Programmes on 15th July 2020 at 10.00AM

1 message

HoD Physics <hod.physics@smvdu.ac.in>
To: pankaj biswas <pankaj.biswas@smvdu.ac.in> Thu, Oct 1, 2020 at 6:39 PM

-------- Forwarded message --------
From: **HoD Mathematics** <hod.math@smvdu.ac.in>
Date: Tue, Jul 14, 2020, 12:41
Subject: Meeting Related to Integrated Programmes on 15th July 2020 at 10.00AM
To: HoD Biotechnology <hod.biotech@smvdu.ac.in>, HoD Physics <hod.physics@smvdu.ac.in>, HoD DOPC <hod.dopc@smvdu.ac.in>, HoD Languages <hod.languages@smvdu.ac.in>
Cc: dean fos <dean.fos@smvdu.ac.in>

Dear Sir/Madam

I am directed to inform all of you that Dean, FoS called a meeting of Heads of School of Sciences, Head SoLL and Head SoPC on 15th July 2020 at 10.00AM in the Conference Room of SoM (D-207), regarding integrated programmes offered by schools. All of you please attend the meeting on the said date and time.

With Regards:

Head,
School of Mathematics
Shri Mata Vaishno Devi University
Katra-182320
Jammu and Kashmir, India

Annexure-III

Shri Mata Vaishno Devi University

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

School of Physics

Annexure-II

Structure of Integrated B.Sc. (Hons.) Physics – M.Sc. Physics

1. Credit Structure:

	Credits Details			%
	Theory + Tutorial + Practical			Credits
	B.Sc.	M.Sc.	B.Sc. + M.Sc.	
I. Core Courses				
Core Courses (Theory) (21 papers)	7 × 4 + 2 × 3 = 34	11 × 4 + 1 × 3 = 47	18 × 4 + 3 × 3 = 81	35.5
Core Course (Tutorial) (4 papers)	4 × 1 = 4	-	4 × 1 = 4	1.8
Core Course (Practical) (11 papers)	8 × 1 = 8	2 × 6 + 1 × 1 = 13	9 × 1 + 2 × 6 = 21	9.2
II. Core Courses Interdisciplinary				
Core Courses (Theory) Interdisciplinary (3 papers)	1 × 4 + 2 × 3 = 10	-	1 × 4 + 2 × 3 = 10	4.4
Core Courses (Tutorial) Interdisciplinary (2 papers)	2 × 1 = 2	-	2 × 1 = 2	0.9
Core Courses (Practical) Interdisciplinary (3 papers)	3 × 1 = 3	-	3 × 1 = 3	1.3
III. Subsidiary Compulsory Courses				
Subsidiary Course (Theory) (6 papers)	6 × 3 = 18	-	6 × 3 = 18	7.9
Subsidiary Course (Tutorial) (3 papers)	3 × 1 = 3	-	3 × 1 = 3	1.3
Subsidiary Course (Practical) (2 papers)	2 × 1 = 2	-	2 × 1 = 2	0.9
IV. Elective Courses				
Discipline Specific Elective (Theory) (6 papers)	4 × 4 = 16	2 × 4 = 8	6 × 4 = 24	10.5
Open Elective (Theory) (4 papers)	2 × 4 = 8	2 × 4 = 8	4 × 4 = 16	7
V. Ability Enhancement Compulsory Courses				
Professional and Written Communication Skills (Theory) (1 paper)	1 × 2 = 2	-	1 × 2 = 2	0.9
Professional and Written Communication (Practical) (2 papers)	2 × 1 = 2	-	2 × 1 = 2	0.9
Environmental Sciences/ Discourse on Human Virtues (Theory) (2 papers)	2 × 4 = 8		2 × 4 = 8	3.5
VI. Skill Enhancement Compulsory Courses				
Physics Workshop Skills/ Basic Instrumentation Skills (Theory) (2 papers)	2 × 3 = 6		2 × 3 = 6	2.6
Physics Workshop Skills/ Basic Instrumentation Skills (Tutorial) (2 papers)	2 × 1 = 2	-	2 × 1 = 2	0.9
VI. Dissertation/ Project				
Minor Project Part-I & II (2 papers)	2 × 4 = 8		2 × 4 = 8	3.5
Project Part-I & II (2 papers)		2 × 8 = 16	2 × 8 = 16	7
Total	**136**	**92**	**228**	**100**

2. Course Structure:

Semester I

First Year

Course Code	Course Title	L-T-P	Credits
PHL 1022	Mechanics	3-1-2	5
PHL 1152	Waves and Optics	4-0-2	5
BTE 1113 / BTE 1109	Conceptual Organic Chemistry/ Basics of Biology	3-0-2	4
MTL 1231	Differential Calculus	3-1-0	4
	Professional Communication	2-0-2	3
	Total Credits	**15-2-8**	**21**

Semester II

First Year

Course Code	Course Title	L-T-P	Credits
PHL 1074	Electromagnetism and EM Waves	(4-0-2)	5
PHL 1051	Circuit Theory	(3-1-2)	5
BTE 1201/ BTE 1114	Coordination Chemistry/ Molecules and Basic Process of Life	(3-0-2)	4
MTL 1232	Integral Calculus	(3-1-0)	4
	Written Communication	(0-0-2)	1
	Total Credits	**13-2-8**	**19**

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School of Physics

Semester III **Second Year**

Course Code	Course Title	L-T-P	Credits
PHL 2024	Thermal Physics and Kinetic Theory	(4-0-2)	5
PHL 2052	Basic Electronics	(3-1-2)	5
PHL 2112	Physics Workshop Skills	(3-1-0)	4
MTL XXXX/ BTE 2301/ BTE 2528	Fundamentals of Algebra/ Fundamentals of Physical Chemistry/ Nutrition and Health	(3-1-0)/ (3-0-2)	4
XXX-XXXX	Open Elective-I (Management/ Humanities/ Engineering/ Philosophy)	(4-0-0)	4
	Total Credits	**(17-3-4)/ (17-2-6)**	**22**

Semester IV **Second Year**

Course Code	Course Title	L-T-P	Credits
PHL 2045	Modern Physics	(4-0-2)	5
PHL 2053	Digital Electronics	(3-1-2)	5
PHL 2113	Basic Instrumentation Skills	(3-1-0)	4
MTL XXXX/ BTE 2401/ BTE 2529	Vector Calculus/ Analytical Methods in Chemistry/ Applications of Biology	(3-1-0)/ (3-0-2)	4
	Studies on Environmental Biology	(4-0-0)	4
	Total Credits	**(17-3-4)/ (17-2-6)**	**22**

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School of Physics

Semester V **Third Year**

Course Code	Course Title	L-T-P	Credits
PHL 3062	Elementary Statistical Mechanics	(4-1-0)	5
PHL 3084	Fundamentals of Materials Science	(4-0-2)	5
PHL 3XXX	DSE-I	(4-0-0)	4
PHL 3XXX	DSE-II	(4-0-0)	4
PCL-3067	Discourse on Human Virtues	(4-0-0)	4
PHD-3132	Minor Project Part-I	(0-0-8)	4
	Total Credits	**(20-1-10)**	**26**

Semester VI **Third Year**

Course Code	Course Title	L-T-P	Credits
PHL 3092	Basic Nuclear Physics	(4-1-0)	5
PHL 3032	Numerical Computation	(4-0-2)	5
PHL 3XXX	DSE-III	(4-0-0)	4
PHL 3XXX	DSE-IV	(4-0-0)	4
XXX XXXX	Open Elective-II (Management/ Humanities/ Engineering/ Philosophy)	(4-0-0)	4
PHD-3133	Minor Project Part-II	(0-0-8)	4
	Total Credits	**(20-1-10)**	**26**

Total credits for the B.Sc. (Hons.) Physics degree = 136

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

School of Physics

Semester VII **Fourth Year**

Course Code	Course Title	L-T-P	Credits
PHL 6021	Classical Mechanics	(4-0-0)	4
PHL 6033	Mathematical Physics	(4-0-0)	4
PHL 6041	Quantum Mechanics-I	(4-0-0)	4
PHL 6054	Physics of Semiconductor Devices	(4-0-0)	4
PHL 6123	Physics Laboratory-I	(0-0-12)	6
	Total Credits	**(16-0-12)**	**22**

Semester VIII **Fourth Year**

Course Code	Course Title	L-T-P	Credits
PHL 6075	Electrodynamics and Plasma Physics	(4-0-0)	4
PHL 6055	Digital Systems	(4-0-0)	4
PHL 6042	Quantum Mechanics-II	(4-0-0)	4
PHL 6113	Computational Physics	(3-0-2)	4
PHL 6124	Physics Laboratory-II	(0-0-12)	6
	Total Credits	**(16-0-12)**	**22**

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SchoolofPhysics

Semester IX **Fifth Year**

Course Code	Course Title	L-T-P	Credits
PHL 7101	Condensed Matter Physics	(4-0-0)	4
PHL 7071	Atomic and Molecular Physics	(4-0-0)	4
PHL 7XXX	DSE-V	(4-0-0)	4
	Open Elective-III (Management/ Humanities/ Engineering/ Philosophy)	(4-0-0)	4
PHD-7134	Project Part-I **	(0-0-16)	8
	Total Credits	**(16-0-16)**	**24**

Semester X **Fifth Year**

Course Code	Course Title	L-T-P	Credits *
PHL 7091	Nuclear & Particle Physics	(4-0-0)	4
PHL 7022	Thermodynamics and Statistical Physics	(4-0-0)	4
PHL 7XXX	DSE-VI	(4-0-0)	4
	Open Elective-IV(Management/ Humanities/ Engineering/ Philosophy)	(4-0-0)	4
PHD-7135	Project Part-II **	(0-0-16)	8
	Total Credits	**(16-0-16)**	**24**

Total credits for the M.Sc. Physics degree = 92

Total credits for the 5 year Int. B.Sc. (Hons.) Physics and M.Sc. Physics Degree:

136 + 92 = 228

*Credit to be earned from seminar presentations on the project during the semester

** Contact hours with the project supervisor

Agendafor 7thmeeting of BoS of SoP via Online Mode

Subsidiary Courses from Physics for other departments/ disciplines: (Credit: 04 each)

Sem.	Course Code	Course Title	L-T-P	Credits
I	PHL 1151	Basic Optics #	(3-0-2)	4
II	PHL 1073	Electromagnetics #	(3-0-2)	4
III	PHL 2023	Heat and Thermodynamics#	(3-0-2)	4
IV	PHL 2044	Foundations of Modern Physics #	(3-0-2)	4

List of Discipline Specific Electives (DSE)*

* (i) Two DSEs each in Semesters V & VI for B.Sc. (Hons.) and
(ii) One DSE each in Semesters IX and X each M.Sc. Physics

UG/ PG	DSE	Course Code	Course Title	L T-P	Credits
UG	DSE-I & DSE-II	PHL 3153	Applied Optics	4-0-0	4
		PHL 3125	Basic Experimental Techniques	4-0-0	4
		PHL 3114	UNIX, Fortran-90 and C++	4-0-0	4
		PHL 3171	Atmospheric and Space Physics	4-0-0	4
		PHL 3056	Fundamentals of Microprocessor	4-0-0	4
	DSE-III & DSE-IV	PHL 3173	Astronomy and Astrophysics	4-0-0	4
		PHL 3093	Nuclear Radiation: Medicine, Agriculture, Energy and Safety	4-0-0	4
		PHL 3181	Biophysics	4-0-0	4
		PHL 3191	Nanoelectronics	4-0-0	4
		PHL 3087	Physics of Crystalline Materials	4-0-0	4
		PHL 3192	Introduction to Nanomaterials	4-0-0	4
		PHL 7059	Advanced Microprocessor	4-0-0	4
		PHL 7077	Plasma Physics and Plasma Processing	4-0-0	4

PG	DSE-V	PHL 7193	Introduction to Nanoscience and Nanotechnology	4-0-0	4
		PHL 7058	Electronic Communication	4-0-0	4
		PHL 7172	Physics of the Earth as a Planet	4-0-0	4
		PHL 7076	Atomic and Molecular Structure	4-0-0	4
	DSE-VI	PHL 7058	Microcontrollers and Embedded Systems	4-0-0	4
		PHL 7107	Electronic Theory of Solids	4-0-0	4
		PHL 7191	Introduction to Photonics and Plasmonics	4-0-0	4
		PHL 7194	Thin Films and Vacuum Technology	4-0-0	4
		PHL 7094	Advanced Particle Physics	4-0-0	4
		PHL 7154	Optical Spectroscopy and Microscopy	4-0-0	4
		PHL 7108	Liquid and Polymer Physics	4-0-0	4

Annexure-IV

Structure for Integrated B.Sc. (Hons.) Physics-M.Sc. Physics program

CREDIT STRUCTURE [Int. B.Sc. (Hons.) Physics-M.Sc. Physics Programme]

	Credits Details Theory + Tutorial + Practical			% Credits
	B.Sc.	M.Sc.	B.Sc. + M.Sc.	
I. Core Courses				
Core Courses (Theory) (19 papers)	10 × 3 + 1 × 2 = 32	8 × 3 = 24	18 × 3 + 1 × 2 = 56	28
Core Course (Tutorial) (4 papers)	-	4 × 1 = 4	4 × 1 = 4	02
Core Course (Practical) (15 papers)	7 × 2 + 2 × 1 = 16	6 × 2 = 12	13 × 2 + 2 × 1 = 28	14
II. Core Courses Interdisciplinary				
Core Courses (Theory) Interdisciplinary (6 papers)	6 × 3 = 18	-	6 × 3 = 18	09
Core Courses (Practical) Interdisciplinary (5 papers)	5 × 1 = 5	-	5 × 1 = 5	2.5
III. Subsidiary Compulsory Courses				
Subsidiary Course (Theory) (7 papers)	7 × 3 = 21	-	7 × 3 = 21	10.5
Subsidiary Course (Tutorial) (3 papers)	3 × 1 = 3	-	3 × 1 = 3	1.5
Subsidiary Course (Practical) (4 papers)	4 × 1 = 4	-	4 × 1 = 4	2
IV. Elective Courses				
Discipline Specific Elective (Theory) (8 papers)	-	6 × 3 = 18	6 × 3 = 18	09
Open Elective (Theory) (4 papers)	2 × 3 = 6	2 × 3 = 6	4 × 3 = 12	06
V. Ability Enhancement Compulsory Courses				
Communication and Comprehension Skills (Theory) (1 paper)	1 × 2 = 2	-	1 × 2 = 2	01
Communication and Comprehension Skills (Practical) (2 paper)	2 × 1 = 2	-	2 × 1 = 2	01
Environmental Sciences and Ethics (Theory) (2 papers)	2 × 2 = 4	-	2 × 2 = 4	02
V. Dissertation/ Project				
Minor Project Part-I & II (2 papers)	3 + 4 = 7	-	3 + 4 = 7	3.5
Project Part-I & II (2 papers)	-	2 × 8 = 16	2 × 8 = 16	08
Total	120	80	200	100

Course Structure of B.Sc. (Hons.) Physics

Semester I	L-T-P	Credits	Semester II	L-T-P	Credits
Waves and Optics	(3-0-0)	3	Electromagnetism and EM Waves	(3-0-0)	3
Mechanics	(3-0-0)	3	Circuit Theory	(3-0-0)	3
Chemistry-I ***(Fundamentals of Physical Chemistry)***	(3-0-2)	4	Chemistry-II ***(Polymer Chemistry)***	(3-0-2)	4
Mathematics-I ***(Calculus and Diff. Eq.)***	(3-1-0)	4	Mathematics-II ***(Vector Calculus)***	(3-1-0)	4
Professional Communication	(2-0-2)	3	Written Communication	(0-0-2)	1
Physics Lab-I **(Meteorology, Errors, Curve fitting, Computer based experiments and data analysis)**	(0-0-6)	3	Physics Lab-II **(Experiments on Electromagnetics, EM waves, Mechanics)**	(0-0-6)	3
	(14-1-10)	20		(12-1-10)	18
Semester III	**L-T-P**	**Credits**	**Semester IV**	**L-T-P**	**Credits**
Thermal and Statistical Physics	(3-0-0)	3	Modern Physics	(3-0-0)	3

Basic Electronics	(3-0-0)	3	Digital Electronics	(3-0-0)	3
Biology-I *(Basics of Biology)*	(3-0-2)	4	Biology-II *(Molecules and Basic Process of Life)*	(3-0-2)	4
Mathematics-III *(Fundamentals of Algebra)*	(3-1-0)	4	Biochemistry, Biotechnology and Biophysics	(3-0-0)	3
Programming and Languages	(3-0-2)	4	Data Structure and Algorithm	(3-0-2)	4
Ethics in Science & Engineering	(2-0-0)	2	Studies on Environmental Biology	(3-0-0)	3
Physics Lab-III	(0-0-6)	3	Physics Lab-IV	(0-0-6)	3
	(17-1-10)	23		(18-0-10)	23
Semester V	**L-T-P**	**Credits**	**Semester VI**	**L-T-P**	**Credits**
Elementary Statistical Mechanics	(3-0-0)	3	Solid State Physics	(3-0-0)	3
Numerical Computation	(2-0-4)	4	Characterization Techniques	(3-0-0)	3
Applied Optics and Communication	(3-0-0)	3	Fundamentals of Materials Science	(3-0-0)	3
Humanities (Open Elective-I)	(3-0-0)	3	Management (Open Elective-II)	(3-0-0)	3
Physics Lab-V	(0-0-4)	2	Physics Lab-VI	(0-0-4)	2
Minor Project Part-I	(0-0-6)	3	Minor Project Part-II	(0-0-8)	4
	(11-0-14)	18		(12-0-12)	18

Total credits for the B.Sc. (Hons.) degree = 120

 # Subsidiary Courses from Physics for other departments/ disciplines

Sem.	Course Code	Course Title	L-T-P	Credits
I	PHL 1151	Basic Optics #	(3-0-2)	4
II	PHL 1073	Electromagnetics #	(3-0-2)	4
III	PHL 2023	Heat and Thermodynamics #	(3-0-2)	4
IV	PHL 2044	Foundations of Modern Physics #	(3-0-2)	4

Course Structure M.Sc. Physics*

Semester VII	L-T-P	Credits	Semester VIII	L-T-P	Credits
Classical Mechanics	(3-1-0)	4	Electrodynamics and Plasma	(3-1-0)	4
Mathematical Physics	(3-1-0)	4	Advanced Quantum Mechanics	(3-1-0)	4
Dielectric, Optical and Magnetic Behaviour of Solids	(3-0-0)	3	Quantum Optics	(3-0-0)	3
Spectroscopy	(3-0-0)	3	Physics of Semiconductor Devices	(3-0-0)	3
Advanced Physics Lab-I	(0-0-12)	6	Advanced Physics Lab-II	(0-0-12)	6
	(12-2-12)	20		(12-2-12)	20
Semester-IX	**L-T-P**	**Credits**	**Semester X**	**L-T-P**	**Credits**
Program Elective-I	(3-0-0)	3	Program Elective-IV	(3-0-0)	3
Program Elective-II	(3-0-0)	3	Program Elective-V	(3-0-0)	3
Program Elective-III	(3-0-0)	3	Program Elective-VI	(3-0-0)	3
Open Elective-III	(3-0-0)	3	Open Elective-IV	(3-0-0)	3
Project Part-I	(0-0-16)	8	Project Part-II	(0-0-16)	8
	(12-0-16)	20		(12-0-16)	20

Total credits for the M.Sc. degree = 120

*** The existing M.Sc. Physics course structure will continue to run as it is.**

Total credits for the 5 year Integrated B.Sc. (Hons.)-M.Sc. Physics Program: 120 + 80 = 200

List of Program Electives (PE)

1. Liquid and Polymer Physics
2. Electronic Communication
3. Plasma Physics and Plasma Processing
4. Solid State Electronics
5. Basic Experimental Techniques
6. Physics of Crystalline Materials
7. Introduction to Photonics & Plasmonics
8. Introduction to Nanoscience and Nanotechnology
9. Introduction to Nanomaterials
10. Electronic Theory of Solids
11. Optical Spectroscopy and Microscopy
12. Thin Films and Vacuum Technology

13. Atomic and Molecular Structure
14. Nanoelectronics
15. Atmospheric and Space Physics
16. Astronomy and Astrophysics
17. Nuclear and Particle Physics
18. Nuclear Physics: Medicine, Agriculture, Energy and Safety
19. Advanced Particle Physics
20. Fundamentals of Microprocessors.
21. Microcontrollers and Embedded Systems
22. Advanced Microprocessor
23. Physics of Earth as a Planet
24. Special Topics

Annexure-V

Laboratory		S. No.	Experiment
Physics Lab-I	Mechanics	1.	Young's Modulus of a Wire by Optical Lever Method
		2.	Coefficient of Viscosity of water by Poiseuille's method
		3.	Value of 'g' using bar pendulum
		4.	Moment of Inertia of a Flywheel
		5.	Elastic constants of a wire by Searle's method
		6.	Bifilar pendulum
		7.	Temperature coefficient of the material of a coil using by Platinum resistance thermometer
		8.	Modulus of rigidity by Maxwell's needle
		9.	Surface tension of water by ring-pull out method
		10.	Laboratory Telescope
		11.	Travelling Microscope
	Waves & Optics + **Subsidiary Lab:** Basic Optics	12.	Frequency of a tuning fork by sonometer
		13.	Refractive index of the material of Prism using Sodium Light
		14.	Wavelength of Sodium Light using a plane diffraction Grating
		15.	Dispersive and resolving powers of a prism
		16.	Refractive index of a liquid using Newton's Rings
		17.	Diffraction of light by single silt or wire
		18.	Determining the concentration of sugar solution using Polarimeter
	Circuit Theory	19.	Self-inductance by Anderson's bridge
		20.	Verification of Network Theorem's
		21.	Characteristics of series & parallel RLC circuits
		22.	Low resistance by Carey Foster Bridge
		23.	Velocity of sound by Lissajous figures method
		24.	Digital Multimeter
		25.	Cathode Ray Oscilloscope (CRO)
	Electromagnetism and EM Waves	26.	Measuring B and its variation in a Solenoid
		27.	Self-inductance by Anderson's bridge

Physics Lab-II	+ **Subsidiary Lab.:** Electromagnetics	28.	Ballistic galvanometer experiments
	CMP Lab M.Sc. (Physics)	29.	Hall effect with accessories
		30.	ESR set up
		31	Thermal Conductivity Setup
	B. Tech. Lab.	32.	Biot-Savart Law setup with accessories

The meeting ended with a vote of thanks to the Member Experts and to the Chair.

The decisions taken by the experts and the members of BoS of SoP for the academic related matters were finally recommended for discussion and approval in the next scheduled Academic Council meeting of the University.

16/10/2020

Dr. S. K. Wanchoo
Assoc. Professor
Member

Dr. Yugal Khajuria
Assoc. Professor
Member

13.10.2020

Dr. Jitendra Sharma
Asstt. Professor
Member

Dr. Kamni
Asstt. Professor
Member

13.10.2020

Dr. Vivek K. Singh
Asstt. Professor
Member

13/10/2020

Dr. Ram Prakash
Asstt. Professor
Member

Dr. Soumitra Mukherjee
Professor
Member Expert (External)

Prof. D.K. Pandya
Professor,
Member Expert (External)

Prof. A.K. Sharma
Head, SoP
Chairman

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

Dr. Pankaj Biswas
Member Secretary BoS, SoP

Head, SoP:

Copy to:

1. Registrar, SMVDU for kind information
2. PS to VC for kind information of the Hon'ble Vice Chancellor.
3. Dean (AA) for information.
4. All members concerned for the information via E-mail.
5. Record/ Office file.

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9.1.J.38

School of Physics

Programme structure of Integrated B.Sc. (Honours) Physics-M.Sc. Physics

ATR w.r.t. Minutes of the 33rd Meeting of Academic Council Agenda Item No. 33.15 Final Course Structure, Course Codes (all semesters) and Course Contents (upto 4 semesters) of Integrated B.Sc. (Honours) Physics-M.Sc. Physics Programme based on the directions passed by Academic Council minutes notified vide No. SMVDU/AA/2021/33-AC/079/dated: 9th Feb. 2021 & IOC vide No. SMVDU/AA/21/162-167 dated: 23rd Feb. 2021

Semester I **First Year**

Course Code	Course Title	L-T-P	Credits
PHL 1022	Mechanics	4-0-0	4
PHP 1022	Mechanics Lab	0-0-2	1
PHL 1152	Waves and Optics	4-0-0	4
PHP 1152	Waves and Optics Lab	0-0-2	1
BTL 1113/ BTL 1101	Basics of Biology/ Conceptual Organic Chemistry	4-0-0	4
BTP 1113/ BTP 1101	Basics of Biology Lab/ Conceptual Organic Chemistry Lab	0-0-4	2
MTL 1234	Differential Calculus and Its Applications	4-2-0	6
LNL 1411	Professional Communication	2-0-2	3
	Total Credits	**18-2-10**	**25**
Subsidiary Course from Physics for other departments/ disciplines: (Credit: 06) for Sem.-I. The subsidiary course and the Lab. needs to be chosen from the same school.			
PHL 1151	Basic Optics	(4-0-0)	4
PHP 1151	Basic Optics Lab	(0-0-4)	2

30/07/21
(Dr. Pankaj Bisnas)

Prof. A.K. Sharma
Head, SoP

Head
Department of Physics
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Semester II **First Year**

Course Code	Course Title	L-T-P	Credits
PHL 1074	Electromagnetism and EM Waves	4-0-0	4
PHP 1074	Electromagnetism and EM Waves Lab	0-0-2	1
PHL 1051	Circuit Theory	4-0-0	4
PHP 1051	Circuit Theory Lab	0-0-2	1
BTL 1114/ BTL 1201	Molecules and Basic Process of Life/ Coordination Chemistry	4-0-0	4
BTP 1114/ BTP 1201	Molecules and Basic Process of Life Lab/ Coordination Chemistry Lab	0-0-4	2
MTL 1235	Integral Calculus and Its Applications	4-2-0	6
LNL 1412	Written Communication	0-0-2	1
	Total Credits	**16-2-10**	**23**
Subsidiary Course from Physics for other departments/ disciplines: (Credit: 06) for Sem.-II The subsidiary course and the Lab. needs to be chosen from the same school.			
PHL 1073	Electromagnetics	(4-0-0)	4
PHP 1073	Electromagnetics Lab	(0-0-4)	2

30/07/24
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School of Physics

Semester III **Second Year**

Course Code	Course Title	L-T-P	Credits
PHL 2024	Thermal Physics	4-0-0	4
PHP 2024	Thermal Physics Lab	0-0-4	2
PHL 2052	Basic Electronics	4-0-0	4
PHP 2052	Basic Electronics Lab	0-0-4	2
PHL 2112	Physics Workshop Skills	2-0-4	4
MTL 2244/ BTL 2301/ BTL 2528	Fundamentals of Computer Programming/ Fundamentals of Physical Chemistry/ Nutrition and Health	4-0-0	4
BTP 2301/ BTP 2528	Fundamentals of Computer Programming Lab/ Fundamentals of Physical Chemistry Lab/ Nutrition and Health Lab	0-0-4	2
*XXX XXXX	Open Elective-I (Management/ Humanities/ Engineering/ Philosophy)	4-0-0	4
	Total Credits	**18-0-16**	**26**
Subsidiary Course from Physics for other departments/ disciplines: (Credit: 06) for Sem.-III The subsidiary course and the Lab. needs to be chosen from the same school.			
PHL 2023	Heat and Thermodynamics	(4-0-0)	4
PHP 2023	Heat and Thermodynamics Lab	(0-0-4)	2

*** Students can choose any course from any other school out of the list of open electives floated by them of given credits.**

30/07/21
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School of Physics

Semester IV **Second Year**

Course Code	Course Title	L-T-P	Credits
PHL 2045	Modern Physics	4-0-0	4
PHP 2045	Modern Physics Lab	0-0-4	2
PHL 2053	Digital Electronics	4-0-0	4
PHP 2053	Digital Electronics Lab	0-0-4	2
PHL 2113	Basic Instrumentation Skills	2-0-4	4
MTL 2245/ BTL 2401/ BTL 2529	Fundamentals of Probability and Statistics/ Analytical Methods in Chemistry/ Applications of Biology	4-1-0/ 4-0-0/ 4-0-0	5/ 4/ 4
MTP 2245/ BTP 2401/ BTP 2529	Fundamentals of Probability and Statistics Lab/ Analytical Methods in Chemistry Lab/ Applications of Biology Lab	0-0-2/ 0-0-4/ 0-0-4	1/ 2/ 2
BTL 2805	Studies on Environmental Biology	4-0-0	4
	Total Credits	**18-1-14/ 18-0-16/ 18-0-16**	**26**
Subsidiary Course from Physics for other departments/ disciplines: (Credit: 06) for Sem.-IV The subsidiary course and the Lab. needs to be chosen from the same school.			
PHL 2044	Foundations of Modern Physics	(4-0-0)	4
PHP 2044	Foundations of Modern Physics Lab	(0-0-4)	2

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Semester V **Third Year**

Course Code	Course Title	L-T-P	Credits
PHL 3062	Elementary Statistical Mechanics	4-0-0	4
PHP 3062	Elementary Statistical Mechanics Lab	0-0-4	2
PHL 3084	Fundamentals of Materials Science	4-0-0	4
PHP 3084	Fundamentals of Materials Science Lab	0-0-4	2
PHL 3XXX	DSE-I	4-0-0	4
PHL 3XXX	DSE-II	4-0-0	4
PCL-3067	Discourse on Human Virtues	4-0-0	4
	Total Credits	**20-0-8**	**24**

Semester VI **Third Year**

Course Code	Course Title	L-T-P	Credits
PHL 3092	Basic Nuclear Physics	4-0-0	4
PHP 3092	Basic Nuclear Physics Lab	0-0-4	2
PHL 3032	Numerical Computation	4-0-0	4
PHP 3032	Numerical Computation Lab	0-0-4	2
PHL 3XXX	DSE-III	4-0-0	4
PHL 3XXX	DSE-IV/ #Dissertation	4-0-0/ 0-0-8	4
*XXX XXXX	Open Elective-II (Management/ Humanities/ Engineering/ Philosophy)	4-0-0	4
	Total Credits	**20-0-8/ 16-0-16**	**24**

*** Students can choose any course from any other school out of the list of open electives floated by them of given credits.**

Credit to be earned from seminar presentations on the project during the semester

Total credits for the B.Sc. (Hons.) Physics degree = 148

30/07/21
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School of Physics

Semester VII **Fourth Year**

Course Code	Course Title	L-T-P	Credits
PHL 6021	Classical Mechanics	(4-0-0)	4
PHL 6033	Mathematical Physics	(4-0-0)	4
PHL 6041	Quantum Mechanics-I	(4-0-0)	4
PHL 6054	Physics of Semiconductor Devices	(4-0-0)	4
PHL 6123	Physics Laboratory-I	(0-0-12)	6
	Total Credits	**(16-0-12)**	**22**

Semester VIII **Fourth Year**

Course Code	Course Title	L-T-P	Credits
PHL 6075	Electrodynamics and Plasma Physics	(4-0-0)	4
PHL 6055	Digital Systems	(4-0-0)	4
PHL 6042	Quantum Mechanics-II	(4-0-0)	4
PHL 6113	Computational Physics	(3-0-2)	4
PHL 6124	Physics Laboratory-II	(0-0-12)	6
	Total Credits	**(15-0-14)**	**22**

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Semester IX **Fifth Year**

Course Code	Course Title	L-T-P	Credits
PHL 7101	Condensed Matter Physics	(4-0-0)	4
PHL 7071	Atomic and Molecular Physics	(4-0-0)	4
PHL 7XXX	DSE-V	(4-0-0)	4
*XXX XXXX	Open Elective-III (Management/ Humanities/ Engineering/ Philosophy)	4-0-0	4
PHD 7134	Project Part-I **	(0-0-16)	8
	Total Credits	**(16-0-16)**	**24**

Semester X **Fifth Year**

Course Code	Course Title	L-T-P	Credits *
PHL 7091	Nuclear & Particle Physics	(4-0-0)	4
PHL 7022	Thermodynamics and Statistical Physics	(4-0-0)	4
PHL 7XXX	DSE-VI	(4-0-0)	4
*XXX XXXX	Open Elective-IV (Management/ Humanities/ Engineering/ Philosophy)	4-0-0	4
PHD-7135	Project Part-II **	(0-0-16)	8
	Total Credits	**(16-0-16)**	**24**

Total credits for the M.Sc. Physics degree = 92

Total credits for the 5 year Int. B.Sc. (Hons.) Physics and M.Sc. Physics Degree: **148 + 92 = 240**

* Students can choose any course from any other school out of the list of open electives floated by them of given credits.

** Contact hours with the project supervisor

30/07/21
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List of Discipline Specific Electives (DSE)*

* (i) Two DSEs each in Semesters V & VI for B.Sc. (Hons.) and
(ii) One DSE each in Semesters IX and X M.Sc. Physics

UG/ PG	DSE	Course Code	Course Title	L T-P	Credits
UG	DSE-I & DSE-II	PHL 3153	Applied Optics	4-0-0	4
		PHL 3125	Basic Experimental Techniques	4-0-0	4
		PHL 3114	UNIX, Fortran-90 and C++	4-0-0	4
		PHL 3171	Atmospheric and Space Physics	4-0-0	4
		PHL 3056	Fundamentals of Microprocessor	4-0-0	4
	DSE-III & DSE-IV	PHL 3173	Astronomy and Astrophysics	4-0-0	4
		PHL 3093	Nuclear Radiation: Medicine, Agriculture, Energy and Safety	4-0-0	4
		PHL 3181	Biophysics	4-0-0	4
		PHL 3191	Nanoelectronics	4-0-0	4
		PHL 3087	Physics of Crystalline Materials	4-0-0	4
		PHL 3192	Introduction to Nanomaterials	4-0-0	4
PG	DSE-V	PHL 7059	Advanced Microprocessor	4-0-0	4
		PHL 7077	Plasma Physics and Plasma Processing	4-0-0	4
		PHL 7193	Introduction to Nanoscience and Nanotechnology	4-0-0	4
		PHL 7058	Electronic Communication	4-0-0	4
		PHL 7172	Physics of the Earth as a Planet	4-0-0	4
		PHL 7076	Atomic and Molecular Structure	4-0-0	4
	DSE-VI	PHL 7058	Microcontrollers and Embedded Systems	4-0-0	4
		PHL 7107	Electronic Theory of Solids	4-0-0	4
		PHL 7191	Introduction to Photonics and Plasmonics	4-0-0	4
		PHL 7194	Thin Films and Vacuum Technology	4-0-0	4

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Head, SoP

		PHL 7094	Advanced Particle Physics	4-0-0	4
		PHL 7154	Optical Spectroscopy and Microscopy	4-0-0	4
		PHL 7108	Liquid and Polymer Physics	4-0-0	4

Semester Wise Credit Distribution

Semester	Year	Credits
I	1st	23
II	1st	25
III	2nd	26
IV	2nd	26
V	3rd	24
VI	3rd	24
Credits (B.Sc.):		148
VII	4th	22
VIII	4th	22
IX	5th	24
X	5th	24
Credits (M.Sc.):		92
Total Credits		240

30/07/21
(Dr. Pankaj Sharma)

Prof. A.K. Sharma
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Katra-182320 (J&K)

Shri Mata Vaishno Devi University

श्री माता वैष्णो देवी विश्वविद्यालय

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

School of Physics

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Detailed Syllabi for B.Sc. Hons. Physics

Semester-I

Mechanics
(PHL-1022) (4-0-0)

Unit-I
Co-ordinate Systems and frames of Reference **8**

Inertial and Non-inertial frames, Pseudo forces, Rotating reference frame, Centrifugal force, Coriolis Force, effect of centrifugal force due to rotation of the earth and coriolis force acting on a freely falling body, Geographical effects of coriolis force (qualitative).

Unit-II
Motion under a Central force **10**

Central forces, Conservative forces, Two-particle central force problem reduced mass, Motion in an inverse square field, Kepler's laws, & Satellite motion (Satellite Launching, Orbital speed, Escape Speed, altitude motion and time period), Gravitational potential and field due to a uniform spherical shell and solid sphere

Unit-III
Mechanics of System of Particles **8**

Basic concepts – Concept of center of mass – Calculation of center of mass of certain geometrical objects like an arc of a circle, rectangle, triangle, solid hemisphere, solid cone and similar simple objects – Conservation laws for a system of particles – Variable mass problems

Unit-IV
Rigid Body Dynamics **10**

Rigid Body, Centre of mass of a rigid body, Translational and Rotational motions, Moment of inertia tensor, Moment of inertia of some regular bodies (ring, disc, rod, sphere, etc.), Angular momentum of a rigid body and inertia tensor, Rotational KE of a rigid body, Euler's Equations.

Unit-V
Collisions **9**

Meaning of collision – Elastic and inelastic collisions – Conservation laws in elastic and inelastic collisions –Introduction to laboratory and centre of mass system, relationship between displacements, velocities, kinetic energies and angles in lab and centre of mass system.

Reference Books:

1. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
2. Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et.al. 2007, Tata McGraw-Hill.
3. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.

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4. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning.
5. Feynman Lectures, Vol.I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education.
6. Mechanics, D.S. Mathur, S.Chand and Company Limited, 2000.
7. University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley.
8. Physics for scientists and Engineers with Modern Phys., J.W.Jewett, R.A.Serway, 2010, Cengage Learning.
9. Mechanics Berkeley Physics course, v.1:Charles Kittel, et.al. 2007, Tata McGraw-Hill.
10. Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press.
11. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Mechanics Lab
(PHP-1022) (0-0-2)

Choose any 6 experiments from the list given below:

1. To determine the Young's modulus of material of a metallic bar by bending of beam method.
2. To determine the coefficient of viscosity of highly viscous liquid by Stoke's method.
3. To find the surface tension of water by Jaeger's Method.
4. To determine the value of 'g' using bar pendulum.
5. To determine the Moment of Inertia of a Flywheel.
6. To determine the Elastic constants of a wire by Searle's method.
7. To find modulus of rigidity by Maxwell's needle.
8. To determine the moment of inertia of objects of regular shapes (rod, sheet, cylinder, sphere, spherical shell) and verify the parallel and perpendicular axes theorems.
9. To study oscillations of a bifilar pendulum.

Reference Books:

1. Practical Physics by G L Squires Cambridge University Press.
2. Advanced Practical Physics for Students by Worsnop and Flint.
3. Practical Physics by R K Shukla.
4. B.Sc Practical Physics by Harnam Singh.
5. B. Sc Practical Physics by C. L. Arora.
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.

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Waves and Optics
(PHL-1152)

(4-0-0)

Unit-I
Waves

8

Wave equation in simple and differential form, general solution of wave equation, velocity of transverse waves in a string, velocity of longitudinal waves in a fluid, energy density and intensity of a progressive wave, reflection and transmissions of transverse waves in a string at boundary (discontinuity), reflection and transmission coefficients, impedance matching.

Unit-II
Geometrical Optics

10

Fermat's principle of least action, Laws of reflection and refraction from Fermat's Principle,reflection and refraction through spherical surfaces, the Newton Formula, Laterial Magnification, Aplanatic points of a sphere, the Cartesian oval, Geometrical proof for the existence of Aplanatic points, the sine condition, Aberrations Spherical aberrations, minimizing spherical aberration, chromatic aberration, condition for achromatism, coma, astigmatism, curvature of the field, Huygen's and Ramsden's eye pieces.

Unit-III
Interference

9

Interference Conditions for sustained interference, theory of interference, Two-Beam Interference, Interference in parallel and wedge shaped films, Achromatic fringes, Color of thin films, Newton's rings and Michelson interferometer and their applications, Multiple beam interference in parallel film and Fabry-Perot interferometer, limit of resolution.

Unit-IV
Diffraction

8

Diffraction Fresnel's diffraction, Zone plate, diffraction due to straight edge. Fraunhofer diffraction due to single (rectangular and circular) and double slits, plane transmission grating and its resolving power.

Unit-V
Polarization

10

Polarization of light, Malus law, polarization by reflection, Brewster's law, Analysis of linearly and circularly polarized light, Polarization by double refraction and Huygen's theory, Nicol prism, Retardation plates, Optical activity and Fresnel's theory, Bi-quartz polarimeter.

Reference Books:

1. Vibrations and Waves, A. P. French, CRC Press, (2001).
2. The Physics of Vibrations and Waves, H. J. Pain, Wiley (2005).

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3. Optics, E. Hecht – Addison Wesley (2002).
4. Optics, A Ghatak Tata McGraw Hill Education (2016).
5. A textbook of Optics, BrijLal and Subrahmanyam, S. Chand and Co.
6. Optics– Jenkins & White, McGraw Hill (2001).

Waves and Optics Lab
(PHP-1152)

(0-0-2)

Choose any 6 experiments from the list given below:

1. To find velocity of sound through a wire using Sonometer.
2. To measure velocity of sound by Lissajous figures method.
3. To determination of frequency of an electrically maintained tuning fork using sonometer.
1. To determine refractive index of a transparent liquid using a travelling microscope.
2. To determine the refractive index of the material of a convex lens by measuring its focal length and radii of curvature.
3. To determine refractive index of a liquid with the help of a convex lens and a plane mirror.
4. To determine of the focal length and power of a convex lens by u-v method.
5. To find refractive index of water by using hollow prism.
6. To find wave length of Sodium light using Newton's Rings.
7. To find the radius of curvature of plano-convex lens using Newton's rings experiment, given λ=5893A°.
8. To determine the refractive index of a liquid by using Newton's rings apparatus.
9. To find wave length by using Diffraction Grating.
10. To determine the wavelength of monochromatic light by Fresnel's biprism.

Reference Books:

1. Practical Physics by G L Squires Cambridge University Press.
2. Advanced Practical Physics for Students by Worsnop and Flint.
3. Practical Physics by R K Shukla.
4. B.Sc Practical Physics by Harnam Singh.
5. An Advanced Course in Practical Physics by D. Chattopadhyay, P.C. Rakshit.
6. A Text Book of Practical Physics, S.K. Ghosh, 2015, New Central Book Agency.
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Detailed syllabus of subsidiary courses offered by other schools to students of integrated B.Sc. (Hons.) Physics – M.Sc. Physics programme to be taken from the respective schools.

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Semester-II

Electromagnetism and EM Waves (PHL-1074)

(4-0-0)

Unit I
Vector Calculus

6

Review of vector algebra, Scalar and vector fields, Gradient of a scalar field and its physical interpretation, Line, surface and volume integrals, Divergence of a vector fieldand its physical significance, Solenoidal field with examples, Gauss's divergence theorem. Curl of a vector field and its physical significance, Stokes' theorem, Irrotational vector field, Vector identities.

Unit II
Electrostatics

12

Gauss's law in integral and differential forms, Line integral of electrostatic field, Conservative nature of electrostatic field, Electric field as the negative gradient of potential, Poisson's and Laplace's equations. Electric quadrupole, Electric field and potential due to quadrupole, Energy of electrostatic field. Dielectrics, Polar and non-polar molecules, Polarisation of dielectric, Polarisation vector $\vec{P}$, Displacement vector $\vec{D}$, Relation between $\vec{P}$, $\vec{E}$ and $\vec{D}$, Atomic polarizability, Electric susceptibility, Relation $K = 1 + \chi_e$, Gauss's law in a dielectric medium (differential and integral forms), Energy in the dielectric system, boundary conditions satisfied by and at the interface between two homogeneous dielectrics.

Unit III
Electric Current and Magnetostatics

10

Current and current density, Equation of continuity, Electrical conductivity, Microscopic form of Ohm's law, Failure of Ohm's law. BiotSavart's law, Ampere's circuit law (integral and differential forms) and its limitations, Modified form of Ampere's Circuit Law, Displacement current, Divergence of magnetic field, Magnetic scalar and vector potentials, Divergence of vector potential, Derivation of Biot-Savart's law from vector potential. Current loop as a magnetic dipole, Relation between magnetic dipole moment and angular, momentum, magnetization vector $\vec{M}$, Magnetisation current, Free and bound currents, Relation between $\vec{B}$, $\vec{H}$ and $\vec{M}$, Magnetic susceptibility and permeability, Boundary conditions satisfied by $\vec{B}$ and $\vec{H}$ at the interface between two media.

Unit IV
Time Varying Fields

10

Integral and differential forms of Faraday's laws of electromagnetic induction, Self-inductance of a solenoid, Mutual inductance of two solenoids, Self-inductance and mutual Inductance of current loops, Reciprocity theorem of mutual inductance, Relation between self and mutual inductances, Coefficient of coupling. Energy stored in a magnetic field, Maxwell's equations (differential and integral forms) and their interpretation, Poynting vector, Poynting theorem and its differential form.

Unit V
Electromagnetic Waves

7

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Electromagnetic waves in vacuum: The wave equations for $\vec{E}$ and $\vec{B}$, Monochromatic plane electromagnetic waves and their transverse nature, Characteristic impedance. Electromagnetic waves in dielectric medium: Propagation in linear media, Reflection and transmission at normal and oblique incidence, Derivation of laws of reflection and refraction. Electromagnetic waves in conductors: Modified wave equations, Skin Depth, and Characteristic impedance.

Reference Books:

1. Vectors by Speigal, Schaum Outline Series.
2. Introduction to Electrodynamics, D. J. Griffiths, Pearson.
3. Electromagnetics, B. B. Laud, New Age International Publisher.
4. Electricity and Magnetism by K.K. Tiwari.
5. Electricity and Magnetism by D. C. Tayal.
6. Electricity and Magnetism by Purcell.
7. Electromagnetism by Pramanik.
8. Schaum's Outline of Electromagnetics, 4th Ed., J. A. Edminister, TMH

Electromagnetism and EM Waves Lab (PHP-1074)

(0-0-2)

Choose any 6 experiments from the list given below:

1. To measure field strength B and its variation in a Solenoid (determinedB/dx).
2. To find Capacity of a Capacitor by Electrical vibrator.
3. To find the Impedance of series LCR circuit.
4. To find low resistance by Carey Foster Bridge (Calibrating Bridgewire).
5. To determine the temperature coefficient of the material of a coil using a Carey-Foster's bridge.
6. Find Horizontal component of Earth's magnetic field by usingvibration and deflection magnetometer.
7. To find Self-inductance by Anderson's bridge.
8. To measure the self-inductance of two coils, mutual inductance between these coils and the coefficient of coupling by Anderson's bridge method.
9. To calibrate a ballistic galvanometer.
   To determine the mutual inductance between a pair of coils using a ballistic galvanometer.

Reference Books:

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

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Circuit Theory
(PHL-1051)

(4-0-0)

UNIT-I
Series-Parallel Networks **9**

Kirchhoff's laws, Ladder networks, Current sources, Conversion of current source to voltage source and vice versa, Current sources in series and parallel, Mesh analysis, Nodal analysis, Bridge networks.

UNIT-II
Network Theorems **9**

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Millman's theorem, Substitution theorem, Reciprocity theorem.

UNIT–III
Capacitive, Inductive and Magnetic Circuits **9**

Transients in capacitative networks, Time constant, Capacitor networks, Energy relations, Introduction to Magnetic circuit, Series and parallel magnetic circuits, Analogy between electromotive force (e.m.f) and magneto motive force (m.m.f), Inductors, resistor-inductor (RL) transients, Time constant.

UNIT–IV
AC Circuits **9**

Introduction to a.c. waveforms, Definition of terminology, Average and effective values, Introduction to phasor notation, Response of basic R, L and C elements to a sinusoidal signal, Frequency response, Power factor, Series and parallel a.c. circuits, Impedance and phase diagram, Voltage divider rule for a.c circuits, Current divider rule for a.c. circuits, Power in a.c. circuits, The power triangle.

UNIT–V
Resonance **9**

Introduction to resonance, Series LCR resonant circuit, Q factor, Variation of impedance with frequency, Selectivity of a series resonant circuit, Parallel LCR resonant circuit, Qfactor, Selectivity curves, Application to tuned filters, Bode plots.

Reference Books

1. Introductory Circuit Analysis. 11th edition. Robert L. Boylestad (2006). Prentice Hall.

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2. Fundamentals of Electric Circuits, 3rd Edition.Charles Alexander and MatthewSadiku (2006).McGraw Hill.
3. Electric Circuit Fundamentals (7th Edition). Thomas L. Floyd (2006).Prentice Hall.
4. Circuit Theory - Analysis and Synthesis, A. Chakrabarti, (2018), DanpatRai& Co.

Circuit Theory Lab (PHP-1051)

(0-0-2)

Choose any 6 experiments from the list given below:

1. To verify Kirchhoff's Laws (KCL/ KVL).
2. To verify Thevenin's theorem
3. To verify Norton's theorem.
4. To verify maximum power transfer theorem.
5. To verify superposition theorem
6. To study of the rise and decay of current in RC circuit.
7. To study of the rise and decay of current RL circuits.
8. To study frequency response of series LCR Circuit and to determine its (a) resonant frequency and (b) the Q-factor.
9. To study frequency response of parallel LCR Circuit and to determine its (a) anti-resonant frequency and (b) the Q-factor.

Reference Books:

1. Practical Physics by G L Squires Cambridge University Press.
2. Advanced Practical Physics for Students by Worsnop and Flint.
3. Practical Physics by R K Shukla.
4. B.Sc Practical Physics by Harnam Singh.
5. B. Sc Practical Physics by C. L. Arora.
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.

Detailed syllabus of subsidiary courses offered by other schools to students of integrated B.Sc. (Hons.) Physics – M.Sc. Physics programme to be taken from the respective schools.

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Semester-III

Thermal Physics (PHL 2024)

(4-0-0)

Unit-I
Thermodynamics-I **9**

Thermodynamic systems, Macroscopic and Microscopic Variables, Thermodynamical Equilibrium, Thermodynamical state, Zeroth law of thermodynamics and concept of Temperature. Heat and Work and their path-dependence, Thermal processes, First law of thermodynamics and internal energy, Joule's law, Applications of first law.

Unit-II
Thermodynamics-II **12**

Second Law of thermodynamics and Entropy, Physical significance of entropy, Reversible and irreversible processes, Carnot cycle, Carnot Engine and Refrigerator, Carnot's Theorem. Thermodynamical scale of temperature, Clausius-Clapeyron's equation, Specific heat of saturated vapour, Clausius theorem, Clausius inequality, Conditions for natural changes, Thermodynamic potentials and Maxwell's equation, Applications of Maxwell's equations, Joule-Thomson effect

Unit-III
Kinetic Theory of Gases **7**

Maxwell-Boltzmann Law of distribution of molecular velocities, Evaluation of r.m.s. Velocity and average and most probable speeds, Mean free path, Transport phenomenon.

Unit-III
Conduction of Heat **5**

Fourier equation for one-dimensional flow of heat and its steady-state solution, Periodicflow of heat (sinusoidal heat current).

Unit-IV
Radiation **12**

Radiation as electromagnetic waves, Emissive and Absorptive powers, Radiation in a hollow enclosure, Black-body radiation, Kirchhoff's Law, Intensity and energy density, Pressure and energy density, Stefan-Boltzmann law, Solar constant and temperature of sun, Temperature of Non-black bodies, Distribution of energy in the spectrum of black body radiation, Adiabatic expansion of black-body radiation, Wein's distribution law, Wein's displacement law, Wein's formula, Rayleigh-Jean's law, Planck's law.

Reference Books:

1. Heat and thermodynamics, Zemansky and Ditman, McGraw Hill, 2017.
2. Kinetic theory of gases, Loeb, Dover Phoenix Editions, 2004.
3. Thermodynamics, E. Fermi, Dover Publications, 1956.
4. Concepts of modern Physics, Arthur Beiser, McGraw-Hill, 2003.

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5. A Treatise on Heat, Saha and Srivastava, The Indian Press Ltd 2006.
6. Thermal Physics, S. Garg, R. M. Bansal, C. K. Ghosh, Tata McGraw Hill, 2013.
Heat and Thermodynamics, H. P. Roy and A. B. Gupta, New Central Book Agency, 2010.

Thermal Physics Lab
(PHP 2024) (0-0-4)

Choose any 6 experiments from the list given below:

1. To determine the thermal conductivity of a bad conductor by the Lee's disc method.
2. To determine the ratio of the specific heats of air by Kundt's tube method.
3. To determine the thermal conductivity of a good conductor by Searle's method.
4. To determine the value of Stefan's constant.
5. To determine the specific heat of a liquid by the method of Newton's law of cooling correction.
6. To find the latent heat of fusion of ice by the method of mixture.
7. To determine specific heat of bad conductor by method of mixture.
8. To find the thermal conductivity of rubber.
9. To study the heating efficiency of electrical kettle with varying voltages.
10. To measure the thermo emf of a given thermo couple.
11. To study the thermal behavior of an electric bulb (filament/torch light bulb).
12. To study of variation of resistance with temperature - thermistor.
13. To verify Stefan's law using a torch bulb.
14. To determine the coefficient of thermal expansion of a metallic rod using an optical lever, mutual inductance between a pair of coils using a ballistic galvanometer.

Reference Books:

1. Practical Physics by G L Squires Cambridge University Press.
2. Advanced Practical Physics for Students by Worsnop and Flint.
3. Practical Physics by R K Shukla.
4. B. Sc Practical Physics by C. L. Arora.
5. B.Sc Practical Physics by Harnam Singh.
6. An Advanced Course in Practical Physics by D. Chattopadhyay, P.C. Rakshit.
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Basic Electronics
(PHL 2052)

(4-0-0)

Unit-I
Basic Electrical Components and Sources **8**

Circuit symbols, working principle, classification according to construction, specifications, and applications of passive components - resistor, capacitor, inductor, transformer, switches, fuses, cables, connectors, batteries, relays and PCBs.

Concept of Ideal Voltage and Current source, internal resistance, ac and dc source, Ohms Law, potential divider arrangement, Different type of signals in Electronics,

Unit II:
P-N Junction and Special Purpose Diodes **12**

Classification of Conductors, insulators and semi-conductors on the basis of energy band diagram-Intrinsic and extrinsic semiconductors. P-type and N-type semi-conductors. Formation of PN junction diode – Forward and reverse characteristics – Diode resistance-Effect of temperature onextrinsic semiconductors, Halfwave, Centre tap and Bridge rectifiers, Filters-qualitative ideas, clipping and clamping circuits-their general applications, Zenerdiode – V-I characteristics-Avalanche and Zener break down mechanisms - Zener voltage, Simple voltage regulator circuit using zener diode. LED, Photodiode, Solar Cell, Optocoupler.

Unit-III:
Bipolar junction transistors and Biasing **10**

Construction of NPN andPNP transistors – their operation modes-operation of NPN and PNP transistors-CB, CE and CCconfigurations and their biasing, Input, Output and transfer characteristics of BJTs in CB and CE modes-Active, saturation and cut-off regions -Bias stability- Load line analysis-operating point. Need for transistor biasing Variations of transistor parameters – stabilityfactor and stabilization – Thermal runaway-Methods of transistor biasing –Base bias with emitterfeedback-Voltage divider bias, Single stage RC coupled amplifier, calculation of mid frequencygain, frequency response curve (qualitative).

Unit-IV
JFETS and MOSFETS **7**

Construction of n-channel and p-channel JFETs-operation of n-channel JFET– Drain characteristics of n-channel JFET-Transfer characteristics – parameters of JFET-comparison between BJT and JFET.JFET biasing circuits, MOSFETS, characteristics and parameters.

Unit-V
Operational amplifiers and oscillators **8**

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Principles of operational amplifiers, offsetparameters, differential gain, CMRR, applications of op-amp: as inverting and non-inverting amplifiers, summing amplifier, difference amplifier, differentiator, integrator, and comparator. Concept of feedback mechanism, oscillators, Barkhausen criterion, RC oscillators (Wein-bridge & Phase-shift), Multivibrators.

Reference Books:

1. A text book of electrical technology, B. L .Theraja, S.Chand and Co.
2. Principals of Electronics,V.K. Mehta ,S.Chand and Co.
3. Electronics Principles, Malvino, Tata McGraw Hill.
4. Electronic Devices and circuits, A. Motorshed, Prentice Hall of India
5. Electronic Devices and Circuits, Bolyestad, Tata McGraw Hill.
6. Electronic Devices and Circuits, Bogart, (6th Ed. 2018), Pearson.
   Electronic Components and Materials, Madhuri Joshi, A.H. Wheeler and Co.

Basic Electronics Lab
(PHP 2052) (0-0-4)

Choose any 6 experiments from the list given below:

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c)DC Current, and (d) checking electrical fuses.
2. To test a signal generator using a CRO.
3. To study PN junction diode characteristics (forward & reverse).
4. To draw V-I characteristics of Zener diode and to study it as a voltage regulator.
5. To find the Ripple factor of Half wave rectifier with different filters.
6. To find the Ripple factor of Full wave rectifier with different filters.
7. To draw characteristics of common baseNPN/ PNP transistor.
8. To draw characteristics of common emitter NPN/ PNP transistor.
9. To design a single stage R-C coupled amplifier and to find its voltage gain.
10. To design Wein-bridge oscillator and to measure its frequency.
11. To design RC phase-shift oscillator and to measure its frequency.
12. To design an inverting amplifier of given gain using Op-amp 741 and study itsfrequency response.
13. To design a non-inverting amplifier of given gain using Op-amp 741 and study its frequency Response.
14. To investigate the use of an op-amp as a practical differentiator.
15. To investigate the use of an op-amp as anpractical integrator.

Reference Books:

1. Practical Physics by G L Squires Cambridge University Press.
2. Advanced Practical Physics for Students by Worsnop and Flint.
3. Practical Physics by R K Shukla.
4. B.Sc Practical Physics by Harnam Singh.
5. An Advanced Course in Practical Physics by D. Chattopadhyay, P.C. Rakshit.
6. A Text Book of Practical Physics, S.K. Ghosh, 2015, New Central Book Agency.
7. B. Sc Practical Physics by C. L. Arora.
8. Basic Electronics-A text Lab Manual, Zbar&Malvino, (Tata McGraw-Hill, 1999).

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Physics Workshop Skills
(PHL 2112)

(2-0-4)

Unit-I
Basic Measurements: **6**

Measuring units, conversion to SI and CGS. Familiarization with meter scale, Vernier calliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains etc.

Unit-II
Mechanical Skill-I: **10**

Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines.

Unit-III
Mechanical Skill-II: **9**

Cutting tools, lubricating oils, Cutting of a metal sheet using blade, Smoothening of cutting edge of sheet using file, Drilling of holes of different diameter in metal sheet and wooden block, Use of bench vice and tools for fitting. Make funnel using metal sheet.

Unit-IV
Electrical and Electronic Skill: **10**

Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.

Unit-V
Introduction to Prime Movers: **10**

Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism, Lifting of heavy weight using lever. braking systems, pulleys, working principle of power generation systems. Demonstration of pulley experiment.

Reference Books:

1. A text book in Electrical Technology - B L Theraja – S. Chand and Company.
2. Performance and design of AC machines – M.G. Say, ELBS Edn.
3. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.

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4. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
5. New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

Detailed syllabus of subsidiary courses offered by other schools to students of integrated B.Sc. (Hons.) Physics – M.Sc. Physics programme to be taken from the respective schools.

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School of Physics

Semester-IV

Modern Physics (PHL 2045)

(4-0-0)

Unit – I
Relativity **8**

Special Relativity-Postulates – Time dilation – Doppler effect – Length contraction – Twin Paradox – Relativistic momentum – Mass and energy – Energy and momentum – General relativity

Unit – II
Matter and Radiations **9**

EM waves – Blackbody radiation – Photoelectric effect – X-rays – Diffraction of X-rays– Compton effect – de Broglie waves – Phase and group velocities – Electron diffraction – Uncertainty principle.

Unit-III
Atomic structure **12**

The nuclear atom –Electron orbits – Atomic spectra – Bohr atom – Energy levels and spectra – Absorption spectra – Finite nuclear mass correction, Sommerfeld model – Bohr's quantization rule – Bohr's correspondence principle – Atomic excitation – Lasers –Vector atom model – L-S and j-j coupling.

Unit-IV
Quantum mechanics **8**

Wave equation – Schrödinger equation – Operators – Postulates of quantum mechanics – Particle in a box – Finite potential well – Introduction to quantum tunneling – Harmonic oscillator.

Unit-V
Quantum theory of hydrogen atom **8**

Schrödinger equation – Separation of variable – Quantum numbers – Quantization of energy – Angular momentum – Electron Probability density, Radiative transitions, Selection Rules, Zeeman effect.

Reference Books:

1. Concepts of Modern Physics, Arthur Beiser, Tata McGraw Hill, (2002), 6th Edition.

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2. Introduction to Modern Physics, H. S. Mani and G. K. Metha, Affiliated East-West Press, (1988).
3. Fundamentals of Physics,DavidHalliday, Robert Resnick and Jearl Walker, John Wiley & Sons, (2004), 7th Edition.
4. Physics for Scientists and Engineers (Extended version),Paul A. Tipler and Gene Mosca, W. H. Freeman and Company, (2007).
5. Introduction to Modern Physics, F. K. Richtmyer, E. H. Kennard and J. N. Cooper, Tata McGraw Hill, (1976), 6th Edition.
6. Physics of the atom, Narosa Publishing House,M. R. Wehr, J. A. Richards Jr and T. W. Adair, (1985). 4th Edition.

Modern Physics Lab
(PHP 2045) (0-0-4)

Choose any 6 experiments from the list given below:

1. To measure Plank constant using LED
2. To determine ionization potential of Mercury
3. To determine e/m by using Thomson's bar magnet.
4. To study the photoelectric effect: variation of photocurrent versus intensity and wavelength of light.
5. To determine the wavelength of $H_\alpha H_\beta$ and H_γ emission line of Hydrogen atom.
6. To determine the absorption lines in the rotational spectrum of Iodine vapour.
7. To determine (1) wavelength and (2) angular spread of He-Ne laser/ solid state laser using plane diffraction grating.
8. To study the atomic spectra of certain noble gases and metallic vapors using diffraction grating and spectrometer.
9. To determine the de Broglie wavelength of an accelerated electron beam using Debeye-Scherrer diffraction method.
10. To confirm the quantum theory of light, that photoelectrons depends only on the frequency of the incident light and is independent of the intensity, and calculate the Planck's constant h.
11. To determine the order of magnitude of charge-to-mass ratio (Specific charge, e/m) of an electron.

Reference Books:

1. Practical Physics by G L Squires Cambridge University Press.
2. Advanced Practical Physics for Students by Worsnop and Flint.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
4. An Advanced Course in Practical Physics by D. Chattopadhyay, P.C. Rakshit.
5. A Text Book of Practical Physics, S.K. Ghosh, 2015, New Central Book Agency.
6. B. Sc Practical Physics by C. L. Arora.

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School of Physics

Digital Electronics (PHL 2053)

(4-0-0)

Unit – I
Number Systems and Logic Gates **10**

Number system, binary numbers, binary coded decimal (BCD), octal and hexadecimal numbers, number system conversion from decimal to others (binary, octal, hexadecimal) and vice-versa, 1's compliments, 2's compliments, binary arithmetic, Basic gates and universal gate operations-NAND and NOR implementation.

Unit-II
Boolean Algebra and Logic Families **12**

Boolean algebraic theorems and properties-Karnaugh map: two and four variable map, POS and SOP simplification, don't care condition. Logic families: characteristics and parameters. TTL gates, TTL open collector gates, CMOS gates, TTL-CMOS interface. Combinational logic design:

Unit-III
Combinational Logic Circuits **7**

Parity checker and generator, half and full adders, demultiplexer, multiplexer, decoders, encoders. Programmable logic array (PLA).

Unit-IV
Flip-Flops **8**

RS flip - flops, clocked RS flip - flop, edge-triggering. JK flip - flop, D-typeflip-flop, JK master slave flip-flop, T flip-flop.

Unit-V
Shift Registers and Counters **8**

Serial–in-serial out. Serial–in–parallel out shift registers, asynchronous counters; decade counter (MOD10 counter); NE 555 timer as astable, monostable and bistable mulitvibrator.

Reference Books:

1. A text book of electrical technology, B. L .Theraja, S.Chand and Co.
2. Principals of Electronics,V.K. Mehta ,S.Chand and Co.
3. Electronics Principles, Malvino, Tata McGraw Hill.
4. Electronic Devices and circuits, A. Motorshed, Prentice Hall of India
5. Electronic Devices and Circuits, Bolyestad, Tata McGraw Hill.
6. Electronic Devices and Circuits, Bogart, (6th Ed. 2018), Pearson.
7. Electronic Components and Materials, Madhuri Joshi, A.H. Wheeler and Co.

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Digital Electronics Lab (PHP 2053)

(0-0-4)

Choose any 6 experiments from the list given below:

1. To study performance of a NOT circuit.
2. To verify De Morgan's theorem and some relationships in Boolean algebra.
3. To design OR & AND logic with diode and resistor.
4. To realize basic logic gates with any type of universal gate NAND/NOR.
5. To form different combinational problems by construction of Truth Table and implement it using basic logic gates.
6. To design half adder circuit and to verify its truth table.
7. To design full adder circuit and to verify its truth table.
8. To design half subtractor, full subtractor, adder-subtractor using full adder.
9. To construct i) RS ii) D, and JK FF circuits using NAND gates.
10. To construct 4-bit shift registers (serial & parallel) using D-type FF.
11. To design and study an astable multivibrator using 555 Timer.
12. To design and study a monostable multivibrator using 555 Timer.

Reference Books:

1. Practical Physics by G L Squires Cambridge University Press.
2. Advanced Practical Physics for Students by Worsnop and Flint.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
4. An Advanced Course in Practical Physics by D. Chattopadhyay, P.C. Rakshit.
5. A Text Book of Practical Physics, S.K. Ghosh, 2015, New Central Book Agency.
6. B. Sc Practical Physics by C. L. Arora.
7. Basic Electronics-A text Lab Manual, Zbar&Malvino, (Tata McGraw-Hill, 1999).

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School of Physics

Basic Instrumentation Skills
(PHL 2113) (2-0-4)

Unit-I

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. **4**

Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only).Specifications of an electronic Voltmeter/Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters. Block diagram ac millivoltmeter, specifications and their significance. **4**

Unit 2

Oscilloscope: Block diagram of basic CRO. CRT, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence. Time base operation, synchronization. Front panel controls. Specifications of CRO and their significance. **6**

Use of CRO: for the measurement of voltage (dc and ac), frequency and time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: principle of working. **3**

Unit 3

Signal and pulse Generators: Block diagram, explanation and specifications of low frequency signal generator and pulse generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis. **4**

Impedance Bridges: Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram and working principles of a Q- Meter. Digital LCR bridges. **3**

Unit 4

Digital Instruments: Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter. **3**

Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution. **3**

List of Practicals:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q- meter.

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4. Measurement of voltage, frequency, time period and phase using Oscilloscope.
5. Measurement of time period, frequency, average period using universal counter/frequency counter.
6. Measurement of rise, fall and delay times using a Oscilloscope.
7. Measurement of distortion of a RF signal generator using distortion factor meter.
8. Measurement of R,L and C using a LCR bridge/ universal bridge.

Open Ended Experiments:

1. Using a Dual Trace Oscilloscope
2. Converting the range of a given measuring instrument (voltmeter, ammeter).

It is further suggested that students may be motivated to pursue semester long dissertation wherein he/she may do a hands-on extensive project based on the extension of the practicals enumerated above.

References:

Essential Readings:

1. Logic circuit design, Shimon P. Vingron, 2012, Springer.
2. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
3. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
4. Digital Circuits and Systems, Venugopal, 2011, Tata McGraw Hill.
5. Electronic Instruementation, H.S. Kalsi, 3rd Ed. Tata McGraw Hill.

Additional Readings:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Performance and design of AC machines - M G Say ELBS Edn.

Detailed syllabus of subsidiary courses offered by other schools to students of integrated B.Sc. (Hons.) Physics – M.Sc. Physics programme to be taken from the respective schools.

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Subsidiary Courses for Other Schools offered by School of Physics

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School of Physics

Basic Optics
(PHL-1151)

(4-0-0)

Unit-I
Geometrical Optics-I

12

Reflection and refraction–laws, Reflection at plane mirror, The principle of reversibility of light, Reflection at curved mirrors–Mirror formula, Refraction at plane surfaces, Total internal reflection and its applications, Refraction through a prism, Dispersion of white light by a prism.

Unit-II
Geometrical Optics-II

9

Refraction at curved surfaces – thin lenses, thick lenses, Lens maker's formula, Thin lens formula, Power of a lens, Combinations of lenses into contact, Chromatic aberration, Spherical aberration, Astigmatism.

Unit-III
Physical Optics-I

12

Interference, Conditions for sustained interference, theory of interference fringes, Youngs double slit experiment, Fresnel's Biprism and its application to determine wave length of sodium light, phase change on reflection, thin films (reflected and transmitted cases), Color of thin films, Newton's rings and their applications.

Unit-IV
Physical Optics-II

12

Diffraction, Fresnel's diffraction and Fraunhofer diffraction, diffraction due to single slit, diffraction due to straightedge, plane transmission grating and its resolving power, limit of resolution.

Reference Books:

7. Schaum's Outline of Optics, Eugene Hecht, McGraw-Hill (1974).
8. Optics, E. Hecht – Addison Wesley (2002).
9. Optics, AGhatak Tata McGraw Hill Education.
10. A textbook of Optics, BrijLal and Subrahmanyam, S. Chand and Co.
11. Fundamentals of Geometrical Optics, V. N. Mahajan, Society of Photo Optical (2014).

Basic Optics Lab
(PHP-1151)

(0-0-4)

Choose any 6 experiments from the list given below:

1. To determine refractive index of a transparent liquid using a travelling microscope.

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2. To determine the refractive index of the material of a convex lens by measuring its focal length and radii of curvature.
3. To determine refractive index of a liquid with the help of a convex lens and a plane mirror.
4. To determine of the focal length and power of a convex lens by u-v method.
5. To find refractive index of water by using hollow prism.
6. To find wave length of Sodium light using Newton's Rings.
7. To find the radius of curvature of plano-convex lens using Newton's rings experiment, given λ=5893A°.
8. To determine the refractive index of a liquid by using Newton's rings apparatus.
9. To find wave length by using Diffraction Grating.
10. To determine the wavelength of monochromatic light by Fresnel's biprism.

Reference Books:

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

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Electromagnetics (PHL 1073) (4-0-0)

Unit I
Electrostatics **15**

Force and electric field due to discrete and continuous charge distribution, Field lines-Flux-Gauss's Law and its applications Electric potential, Work done in assembling a charge distribution, Electric dipole-field lines-force and torque on a dipole due to external static electric field Interaction energy between two dipoles, Conductors and capacitors, Boundary conditions for conductors.

Unit II
Electrostatics Fields in Matter **10**

Polarization-restricting to linear, isotropic and homogeneous medium, Surface and bound charge density, Electric displacement vector, Gauss's law in materials, Work done in assembling free charges in the vicinity of dielectric materials, Boundary conditions

Unit III
Magnetostatics **10**

Force Law-line current, surface current and volume current densities, Equation of continuity, Biot-Savart law-properties of B, Magnetic flux-DivB-Magnetic vector potential A, Curl B Ampere's law, Force and torque on a magnetic dipole due to external static magnetic field.

Unit IV
Magnetostatic Fields in Matter **10**

Magnetization–bound and surface charge densities, Auxillary field H, Boundary conditions, Force on a charged particle under electric and magnetic fields.

Reference Books:

1. Introduction to Electrodynamics, D. J. Griffiths, Pearson.
2. Electromagnetics, B. B. Laud, New Age International Publisher.
3. Elements of Electromagnetics, Methew N. O. Sadiku.
4. Electromagnetism, I. S. Grant and W. R. Phillips.
5. Schaum's Outline of Electromagnetics, 4th Ed., J. A.Edminister, TMH

Electromagnetics Lab (PHP 1073) (0-0-4)

Choose any 6 experiments from the list given below:

1. To determine e/m ratio by Millikan's Oil-drop method.
2. To verify Biot-Savart's law.
3. To measure field strength B and its variation in a Solenoid (determine dB/dx).

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4. To find Capacity of a Capacitor by Electrical vibrator.
5. Find Horizontal component of Earth's magnetic field by using vibration and deflection magnetometer.
6. To find Self-inductance by Anderson's bridge.
7. To calibrate a ballistic galvanometer.
8. To determine the mutual inductance between a pair of coils using a ballistic galvanometer.

Reference Books:

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. An Advanced Course in Practical Physics by D. Chattopadhyay, P.C. Rakshit.
5. A Text Book of Practical Physics, S.K. Ghosh, 2015, New Central Book Agency.

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School of Physics

Heat and Thermodynamics (PHL 2023) (4-0-0)

Unit-I
Kinetic Theory of Gases **12**

Pressure exerted by perfect gas, Maxwell's law of distribution of molecular velocities - degrees of freedom, principle of equipartition of energy - application in simple cases. Equation of state - defects of ideal gas equation, van der Waals equation, critical constants.

Unit-II
Thermal Conductivity **12**

Thermal properties of materials, Specific Heat, Density of states, Thermal conductivity in solids, Modes of heat transfer, Cylindrical shell method, Lee's disc method, Heat conduction through a compound media.

Unit-III
Thermodynamics **12**

Introduction to thermodynamics - First law of thermodynamics and its applications, Isothermal and adiabatic changes - Reversible and irreversible processes, second law of thermodynamics, Carnot cycle and its efficiency, entropy and its physical interpretation.

Unit-IV
Radiation **9**

Nature of radiant heat, emissive and absorptive power, Kirchhoff's law, black body radiations, Stefan's law, Newton's law of cooling, Planck's distribution law, Wien's displacement law, pyrometer.

Reference Books:

1. Heat and thermodynamics, Zemansky and Ditman, McGraw Hill, 2017.
2. Kinetic theory of gases, Loeb, Dover Phoenix Editions, 2004 .
3. Thermodynamics, E. Fermi, Dover Publications, 1956,
4. A Treatise on Heat, Saha and Srivastava, The Indian Press Ltd 2006.
5. Thermal Physics, S. Garg, R. M. Bansal, C. K. Ghosh, Tata McGraw Hill, 2013.
6. Heat and Thermodynamics, H. P. Roy and A. B. Gupta, New Central Book Agency, 2010.

Heat and Thermodynamics Lab (PHP 2023) (0-0-4)

Choose any 6 experiments from the list given below:

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1. To determine the thermal conductivity of a bad conductor by the Lee's disc method.
2. To determine the ratio of the specific heats of air by Kundt's tube method.
3. To determine the thermal conductivity of a good conductor by Searle's method.
4. To determine the value of Stefan's constant.
5. To determine the specific heat of a liquid by the method of Newton's law of cooling correction.
6. To find the latent heat of fusion of ice by the method of mixture.
7. To find the thermal conductivity of rubber.
8. To measure the thermo emf of a given thermo couple.
9. To study the thermal behavior of an electric bulb (filament/torch light bulb).
10. To study of variation of resistance with temperature - thermistor.

Reference Books:

1. Practical Physics by G L Squires Cambridge University Press.
2. Advanced Practical Physics for Students by Worsnop and Flint.
3. Practical Physics by R K Shukla.
4. B. Sc Practical Physics by C. L. Arora.
5. B.Sc Practical Physics by Harnam Singh.
6. An Advanced Course in Practical Physics by D. Chattopadhyay, P.C. Rakshit.

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Foundations of Modern Physics
(PHL 2044) (4-0-0)

Unit – I
Special Theory of Relativity **10**

Postulates – Lorenz transformations – Time dilation – Length contraction – Doppler effect – Twin paradox – velocity addition – relativistic momentum – Mass energy equivalence – Electricity and Magnetism in relativity – Introduction to general relativity.

Unit – II
Matter and Radiations **9**

EM waves – Black body radiation – Photoelectric effect – X-rays – Diffraction of x-rays– Compton effect – de Broglie waves – Phase and group velocities – Electron diffraction – Uncertainty principle.

Unit-III
Quantum mechanics **8**

Wave equation – Schrödinger equation – Operators – Postulates of quantum mechanics – Particle in a box – Finite potential well – Introduction to quantum tunneling – Harmonic oscillator.

Unit-IV
Hydrogen atom **9**

Schrödinger equation – Separation of variable – Quantum numbers – Quantization of energy – Angular momentum – Electron Probability density, Radiative transitions, Selection Rules, Zeeman effect.

Unit-V
Atomic structure **9**

Electron orbits – Atomic spectra – Bohr atom – Energy levels and spectra – Absorption spectra – Finite nuclear mass correction, Sommerfeld model – Bohr's quantization rule, Bohr's correspondence principle, Vector atom model, L-S and j-j coupling.

Suggested books:

1. Concepts of Modern Physics, Arthur Beiser, Tata McGraw Hill, (2002), 6th Edition.
2. Introduction to Modern Physics, H. S. Mani and G. K. Metha, Affiliated East-West Press, (1988).
3. Fundamentals of Physics, David Halliday, Robert Resnick and Jearl Walker, John Wiley & Sons, (2004), 7th Edition.

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4. Physics for Scientists and Engineers (Extended version), Paul A. Tipler and Gene Mosca, W. H. Freeman and Company, (2007).
5. Introduction to Modern Physics, F. K. Richtmyer, E. H. Kennard and J. N. Cooper, Tata McGraw Hill, (1976), 6th Edition.
6. Physics of the atom, Narosa Publishing House, M. R. Wehr, J. A. Richards Jr and T. W. Adair, (1985). 4th Edition.

Foundations of Modern Physics Lab
(PHP 2044) (0-0-4)

Choose any 6 experiments from the list given below:

1. To measure Plank constant using LED.
2. To determine ionization potential of Mercury.
3. To determine e/m by using Thomson's bar magnet.
4. To study the photoelectric effect: variation of photocurrent versus intensity and wavelength of light.
5. To measure the value of Planck's constant 'h' with the help of a photoelectric cell.
6. To measure charge-to-mass ratio (Specific charge, e/m) of an electron by helical coil method.
7. To setup the Millikan oil drop apparatus and determine the charge of an electron.
8. To determine the speed of propagation of light 'c' in glass.
9. To determine value of Boltzmann constant using V-I characteristic of PN diode.
10. To measure the high resistance by using loss of charge method.

Reference Books:

1. Practical Physics by G L Squires Cambridge University Press.
2. Advanced Practical Physics for Students by Worsnop and Flint.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
4. An Advanced Course in Practical Physics by D. Chattopadhyay, P.C. Rakshit.
5. A Text Book of Practical Physics, S.K. Ghosh, 2015, New Central Book Agency.
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