ST.TERESA'S COLLEGE
(AUTONOMOUS)
ERNAKULAM

(Affiliated to Mahatma Gandhi University, Kottayam)

CURRICULUM AND SYLLABI FOR

BACHELOR'S PROGRAMME IN

PHYSICS

AND

SYLLABI FOR COMPLEMENTARY COURSES

IN

PHYSICS

Under Choice Based Credit & Semester System

(2018 Admissions)

DEPARTMENT OF PHYSICS

BOARD OF STUDIES IN PHYSICS

Sl No.	Name of the member	Official Address	Designation
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2	**Dr. S. Jayalakshmi**	**Professor, Department of Physics, Cochin University of Science and Technology, Cochin-22**	**Subject Expert**
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4	**Dr. M. K. Jayaraj**	**Professor, Dept. of Physics, Cochin University of Science and Technology, Cochin-22**	**Subject Expert (invited)**
5	**Dr. Titus Mathew**	**Professor, Dept. of Physics, Cochin University of Science and Technology, Cochin-22**	**Subject Expert (invited)**
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Sl No.	Name of the member	Official Address	Designation
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8.	**Dr. Kala M.S**	**Associate Professor, Dept. of Physics, St. Teresa's College, Ernakulam.**	**Member**
9.	**Dr. Santhi. A**	**Assistant Professor, Dept. of Physics, St. Teresa's College, Ernakulam.**	**Member**
10	**Dr. Mariyam Thomas**	**Assistant Professor, Dept. of Physics, St. Teresa's College, Ernakulam.**	**Member**

FACULTY MEMBERS WHO HAVE CONTRIBUTED TOWARDS THE CURRICULUM AND SYLLABUS IN PHYSICS

Sl No.	Name of the member	Official Address
1.	**Dr. Sajimol Augustine M**	**Principal, St. Teresa's College, Ernakulam**
2.	**Smt. Tessy Joseph**	**Head of the Department, Dept. of Physics, St. Teresa's College Ernakulam**
3.	**Dr. Rose P Ignatius**	**Associate Professor, Dept. of Physics, St. Teresa's College Ernakulam**
4.	**Dr. Kala M S**	**Associate Professor, Dept. of Physics, St. Teresa's College Ernakulam**
5.	**Smt. Priya Parvathi Ameena Jose**	**Assistant Professor, Dept. of Physics, St. Teresa's College Ernakulam**
6.	**Smt. Mary Vinaya**	**Assistant Professor, Dept. of Physics, St. Teresa's College Ernakulam**
7.	**Dr. Santhi A**	**Assistant Professor, Dept. of Physics, St. Teresa's College Ernakulam**
8.	**Smt. Minu Pius,**	**Assistant Professor, Dept. of Physics, St. Teresa's College Ernakulam**
9.	**Smt. Susan Mathew,**	**Assistant Professor, Dept. of Physics, St. Teresa's College Ernakulam**
10.	**Dr. Mariyam Thomas ,**	**Assistant Professor, Dept. of Physics, St. Teresa's College Ernakulam**

Sl No.	Name of the member	Official Address
11.	**Smt. Shajira P.S.**	**Assistant Professor(FDP substitute), Dept. of Physics, St. Teresa's College, Ernakulam**
12.	**Dr. Radhu S.**	**Assistant Professor(FDP substitute), Dept. of Physics, St. Teresa's College, Ernakulam**
13.	**Smt. Linu Mary Joseph**	**Assistant Professor(FDP substitute), Dept. of Physics, St. Teresa's College, Ernakulam**
14.	**Ms. Malu S.**	**Guest Lecturer, Dept. of Physics, St. Teresa's College, Ernakulam**

PREFACE

As an autonomous college under Mahatma Gandhi University, St. Teresa's College has taken conscientious efforts to strengthen the curriculum by retaining all the fundamental stipulations of the University/Higher Education Council, to ensure a well-balanced Curriculum. Within the constraints of a prescribed syllabus, we have resolved to take a collective effort to create an inspiring academic culture in the institution, essential for teachers and students to access deeper knowledge and participate in its expansion and transmission. It is also to re-articulate the almost lost or forgotten fact that production and transmission of Quality Knowledge, essential for the development of students in particular and society in general, are the primary functions of any Educational Institution.

The Syllabus restructuring of 2018 aims to provide the students many opportunities to engage with authentic, real world learning. This has been evident through the significant number of new Programmes introduced at the wake of autonomy in 2014 with their integral placement opportunities. Increasingly, however, opportunities for engagement in work-based learning that can be provided through the curriculum across a range of subject areas are creating new and exciting ways to support student learning.

I acknowledge the efforts taken by the teachers in developing Programme and Course outcomes that focus on cognitive and intellectual skills of the learners ,confidence to carry out independent and scholarly research in area of professional interest to them and to position themselves globally effective cross- cultural educators .

I congratulate the efforts taken by the Principal Dr. Sajimol Augustine M. and the team for restructuring the syllabi under the leadership of Smt. Shanty B.P in a meaningful manner. Transformation is what makes St. Teresa's distinctive. Transforming lives in order to make a real impact on the local and international stage through the creation, sharing and application of knowledge. We look forward to sharing with you the outcomes of our curriculum restructuring and these resources we hope will enable you to reflect on learning gain in our own institution.

Dr. Sr. Vinitha (Celine E)

Director

FOREWORD

Autonomy in the field of higher education implies responsibility and accountability and this in turn leads to excellence in academics and pro-active governance. St Teresa's College was given autonomous status in the year 2014 and we have made a concerted attempt to maintain a high level of quality in the standard of education that we impart.

Academic autonomy has granted us the freedom to fine tune the syllabus keeping in mind the changing needs of the new generation of students. Education in the current scenario throws up a multitude of challenges and the curricula and syllabi ought to reflect the paradigm shift that has occurred in the various disciplines. Structured feedback was taken from the Students, Alumni and the experts from the industry and the changes suggested by them were duly incorporated in the syllabi.

The Board of Studies constituted for each department meet regularly in the stipulated time frame and in depth discussions are conducted about the different dimensions of the curricula and syllabi. The IQAC team has felicitated the conduct of a number of workshops and conferences to equip the faculty with the necessary skill set to frame the syllabi, set question papers for internal tests that evaluate whether the learning outcomes enlisted in the syllabus have been achieved and to ensure the fair and transparent conduct of examinations.

The responsibility that autonomy has placed on us is indeed onerous but we have strived together to meet all the challenges that were placed in our way. We have worked towards moulding young women as responsible citizens who will carry forward the task of nation building in an exemplary manner. All effort has been made to nurture their academic ambitions as well as their skills in co-curricular activities.

With sincere gratitude I acknowledge the instinct support and constant guidance extended by Rev. Sr. Dr. Vinitha, the Director of the College.

I specially thank the team headed by Smt. Shanty B. P. for updating the syllabi, the Heads of the Departments and all the faculty members for their diligence, commitment and exceptional contribution towards this endeavour.

Dr. Sajimol Augustine M
Principal

ACKNOWLEDGEMENT

Revising syllabus is a continuous process to provide an updated education to the student community. The prime objective is to frame a dynamic curriculum to accommodate the fast paced development in the knowledge of Physics.With this view the bachelor's program in Physics is designed with equal emphasis on both classroom lectures and laboratory training with modern equipments so that students can compete and perform well in National level entry tests for their higher studies.

The Board of studies in Physics, St. Teresa's college had introduced the first revised syllabus for the students from 2015 admission onwards. We have sought feedbacks on syllabus and curriculum from the stake holders of UG programme –the students, parents and from the faculty. According to their suggestions to adapt to the new demands of industry and research we have made possible modifications to the curriculum and syllabus which is to be implemented for the UG students from 2018 admission onwards.

Our director Dr. Sr.Vinitha has always rendered motivation and help in all our ventures and she was the driving force behind this new curriculum. On behalf of Physics department, St.Teresa's College, I am happy to express my sense of gratitude to her.

In the preparation of this syllabi for core courses of Bachelor's programme in Physics, complementary courses in Physics and for Physics open courses, we have received cheerful cooperation and many helpful comments from the members of Board of studies. It is a special pleasure to thank them for their remarks have been of great benefit to us in shaping the syllabus.

At this juncture I feel deeply honoured in expressing my sincere thanks to Dr.Sajimol Augustine M.,Principal, St Teresa's College,Ernakulam for rendering whole hearted support in finalising the syllabus.

I would like to express my special appreciation and thanks to all the faculty members of our department whose collective work and fruitful discussions only enabled us to structure the syllabus into its final version.

I wish to record my gratitude to our students for their active participation in the discussions we had on various aspects of curricula.

I take this opportunity to express my profound gratitude and deep regards to the former faculty members of the Department Rev. Sr. Merita, Smt. Daisy A Punnose, Smt. K A Anne, Smt. Lucy V J, Dr Annie Joseph Vallamattom and Smt. Shalini Rose who moulded us to face any challenge successfully in the academic realm.

The suggestions of of Prof Jogy Alex, Dept of Chemistry, St Thomas College Pala, Syllabus committee and of IQAC have been helpful to give shape to the overall structure of the curriculum.

Dr. Rose P. Ignatius
Chairperson, Board of Studies in Physics
St. Teresa's college (Autonomous), Ernakulam

CONTENTS

PREAMBLE

The academic system contributes to the acquisition of relevant knowledge and development of skills that learners need to apply in the context of their studies, daily life and career. Curriculum plays an important role in forging lifelong learning competencies, and social attitudes. Board of Studies in Physics has designed the curriculum for Physics with an aim to support and encourage the broad instructional goals such as basic knowledge of the discipline of Physics including phenomenology, theories and techniques, concepts and general principles. In effect, the desire to pursue learning with curiosity, integrity and intellectual rigour will be encouraged. This is to be supplemented with the ability to address the questions related to Physics with qualitative and quantitative reasoning and by experimental investigation. The thrust is also given in ensuring flexible pathways to employment, higher research degrees and many professional postgraduate programmes. With this in mind, we aim to provide a firm foundation in every aspect of Physics and to explain a broad spectrum of modern trends in Physics and to develop experimental, computational and mathematics skills of students.

Department of Physics, St. Teresa's College, has always played a key role in designing the curriculum and syllabus of Mahatma Gandhi University and of various other Universities. The Board of studies acknowledges and appreciates the good effort put in by the faculty members of Physics Department to frame the syllabus for B. Sc. Programme in Physics for the institution which will be implemented for the admissions from 2018 onwards.

GRADUATE ATTRIBUTES

On completion of the B.Sc. programme in Physics, Students should be able to demonstrate the graduate attributes listed below.

- Systematic functional knowledge and understanding of core physical concepts, principles and theories and their applications.
- Proficiency in the appropriate use of contemporary technology in Physics.
- Ability to apply effective, creative and innovative solutions both independently and cooperatively to current and future problems in Physics.
- Adequate knowledge in Statistical methods to understand and analyse problems in science.
- Skills in the use of computers for control, data acquisition and data analysis in experimental investigations.
- Efficiency in the analysis of complex physical problems and the use of mathematical and other appropriate techniques including computer technology to solve them.
- Commitment to the highest standards of professional endeavour.
- Ability to work both autonomously and collaboratively.
- Proficiency to demonstrate effective communication in oral and written English language.
- Confidence in using a second language Hindi, Malayalam or French for effective communication.
- Ability to be a self-directed learner, fostering a healthy intellectual curiosity in Physics as well as in other disciplines and the ability to determine one's own learning needs and to organise one's own learning.
- Independent to plan, execute, analyse and report upon the results of an experiment or investigation.
- Professional skills of team work, independent learning, information retrieval, critical analysis and communication of scientific concepts in writing and orally.
- Enthusiasm and curiosity in Physics and its applications and confidence in the work using

principles of Physics.

- Encouraged to become informed, responsible and respected members of society.

Also the course enables graduates to be ethically informed and able to

- Demonstrate respect for the dignity of each individual and for human diversity.
- Recognize responsibility for common good, environment and society.
- Demonstrate values, knowledge, skills and attitudes appropriate to the discipline and profession.
- Solve problems taking local and international perspectives into account.
- Utilise information and communication and other technologies effectively for the betterment of society and mankind.

OBJECTIVES OF THE PROGRAMME

By the end of the first year (2^{nd} semester),

1) The students should have attained a common level understanding in basic mechanics and properties of matter,
2) A secure foundation in mathematics and other relevant subjects to complement the core for their future courses,
3) Developed their experimental and data analysis skills through a wide range of lab experiments.

By the end of the second year (4^{th} semester),

1) The students should have been introduced to a broad spectrum of topics in Electricity, Electronics and Electrodynamics.
2) Familiarised with additional relevant mathematical techniques and other relevant subjects to complement the core.
3) Developed their experimental skills through a series of experiments supplementing major themes of the lecture courses.
4) Obtained effective communication skills.

By the end of the third year (6^{th} semester),

1) The students should have understood how their actions affect the environment, built knowledge and skills necessary to address complex environmental issues, as well as ways they could take action to keep our environment healthy and sustainable for the future.
2) The students should have covered a range of topics in almost all areas of physics including quantum physics, solid state physics, computational physics, optics and spectroscopy, nuclear physics, thermal and statistical physics and electronics,
3) Undergone through the experience of independent work such as projects; seminars and assignments,
4) Specialised in one of the frontier area of Physics via Choice Based learning.

PROGRAMME DESIGN

The B.Sc. programme in Physics includes (a) Common courses, (b) Core courses, (c) Complementary Courses, (d) Open Courses and (e) Project. No course shall carry more than 4 credits. The student shall select any Choice based course offered by the department which offers the core courses, depending on the availability of teachers and infrastructure facilities, in the institution. Open course shall be offered in any subject and the student shall have the option to do courses offered by other departments.

Courses

The Bachelor's programme contains 33 courses in six semesters. The total credits of all the courses of the programme are 120. The number of Courses for the programme should contain 12 compulsory core courses, 6 core practicals and 1 choice based course from the frontier area of the core courses and a project; 8 complementary courses, from the relevant subjects for complementing the core of study. There should be 10 common courses which includes the first and second language of study. The programme also includes 1 project and 1 open course.

Open course and Choice Based Core course

All students are expected to do one open course of their choice from any discipline other than their parent discipline. Departments have the freedom to change current papers /choose other papers if found relevant. But changes should not affect number of teaching hours (workload of each teacher) of each department. All students have to also do a choice based course.

Project

All students shall do a project related to the core course. The project can be done individually or as a group of maximum 3 students. However, the viva on this project will be conducted individually. The projects are to be identified during the 5^{th} semester of the programme with the help of the supervising teacher. The report of the project in duplicate is to be submitted to the department by the end of 6^{th} semester and are to be produced before the external examiners.

PROGRAMME STRUCTURE

B.Sc. PHYSICS (MODEL I)

A	**Programme Duration**	**6 Semesters**
B	**Total Credits required for successful completion of the Programme**	**120**
C	**Credits required from Common Course I**	**22**
D	**Credits required from Common Course II**	**16**
E	**Credits required from Core course (including Project) and Complementary courses**	**79**
F	**Open Course**	**3**
G	**Minimum attendance required**	**75%**

COURSES

The programme (Model I) consists of common courses with 38 credits, core course, Choice based course, and complementary courses with 79 credits and open course with 3 credits.

SCHEME OF COURSES

The different types of courses and its number and credits are as follows:

Model - I		
Courses	**No.**	**Credits**
Common Course1	10	22
Common course 2		16
Core Courses	12	47
Core Practicals	6	
Project	1	1
Choice based core course	1	3
Complementary courses I & II	8	28
Open Course	1	3
Attendance		75%
Total	**39**	**51 (Core)** **28 (Complementary)** **3 (Open course)** **38 (Common)**
Grand Total	**39**	**120**

COURSE CODE FORMAT

Every course is coded using 9/10 digit alpha numeric code

Every course in the programme should be coded according to the following criteria.

- The first two letters of the code indicates the name of programme i.e. PH for Physics.
- One digit to indicate the semester. ie., PH1 (Physics, 1st semester)
- One letter A(common course), B(core course),C(complementary course), D (open course)is allotted indicating the type of the course.
- The letter/letters P / PR follows it to indicate practical/ project
- For core courses, the next two digits indicate relative position of the course in the programme. For complementary courses, the digits '01' are allotted for complementary physics for B.Sc. Mathematics and '02' that for B.Sc. Chemistry.
- The letter ' B' which follows indicates the programme is for bachelors
- The last two digits '18' stands for 2018 the year in which the syllabus is implemented.

SCHEME OF DISTRIBUTION OF INSTRUCTIONAL HOURS FOR CORE COURSES

Semester	Model I	
	Theory	**Practical**
First	2	2
Second	2	2
Third	3	2
Fourth	3	2
Fifth	13	8
Sixth	17	8

DURATION OF PROGRAMME

- The duration of U.G. Programmes shall be **6 semesters**.
- A student may be permitted to complete the programme, on valid reasons, within a period of 12 continuous semesters from the date of commencement of the first semester of the programme.
- Attendance: Students having a minimum of 75% average attendance for all the courses only, can register for the examination.

PROGRAMME STRUCTURE

B.Sc. Physics Programme – (MODEL - I)

DISTRIBUTION OF COURSES FOR BACHELOR'S PROGRAMME IN PHYSICS

Sem.	Course Type	Course Code	Title of the Course	Hours / week	Credits	Max. Marks	
						ISA	ESA
I	Common course I	EN1A01B18	Fine-tune Your English	5	4	20	80
		EN1A02B18	Pearls from the Deep	4	3	20	80
	Common course II	HN1A01B18	Kahaani Aur Upanyas	4	4	20	80
		FR1A01B18	French Language and communicative skills -I				
		MA1A01B18	Kathasahithyam				
	Complementary course I	MT1C01B18	Calculus	4	3	20	80
	Complementary course II	ST1C01B18	Descriptive Statistics	4	3	20	80
	Core Course	**PH1B01B18**	**Methodology and Perspectives of Physics**	2	2	15	60
	Core Practical	**PH2BP01B18**	Core Practical I **Mechanics, Properties of matter and Optics I**	2	*	*	*
Total Credits for Semester I = 19							

Sem.	Course Type	Course Code	Title of the Course	Hours / week	Credits	Max. Marks	
						ISA	ESA
II	Common course I	EN2A03B18	Issues that Matter	5	4	20	80
		EN2A04B18	Savouring the Classics	4	3	20	80
	Common course II	HN2A03B18	Kavita Vyakaran Aur Anuvad	4	4	20	80
		FR2A03B18	French Language and communicative skills-II				
		MA2A03B18	Kavitha				
	Complementary course I	MT2C01B18	Partial Derivatives, Multiple integrals Trigonometry and Matrices	4	3	20	80
	Complementary course II	ST2C01B18	Probability and Random Variables	4	3	20	80
	Core Course	**PH2B02B18**	**Mechanics and Properties of Matter**	2	2	15	60
	Core Practical	**PH2BP01B18**	Core Practical I **Mechanics, Properties of matter and Optics I**	2	2	10	40
Total Credits for Semester II = 21							

Sem.	Course Type	Course Code	Title of the Course	Hours / week	Credits	Max. Marks	
						ISA	ESA
III	Common Course I	EN3A05B18	Literature and/as Identity	5	4	20	80
	Common Course II	HN3A05B18	Naatak AurLambi Kavita	5	4	20	80
		FR3A05B18	An Advanced course in French -I				
		MA3A05B18	Drisyakalasahithyam				
	Complementary course I	MT3C01B18	Vector Calculus, Differential Equations and Analytic Geometry	5	4	20	80
	Complementary course II	ST3C01B18	Probability Distributions	5	4	20	80
	Core Course	**PH3B03B18**	**Electronics**	3	3	15	60
	Core Practical	**PH4B04B18**	Core Practical II **Mechanics, Properties of matter and Optics II**	2	*		

Total Credits for Semester III = 19

Sem.	Course Type	Course Code	Title of the Course	Hours / week	Credits	Max. Marks	
						ISA	ESA
IV	Common course I	EN4A06B18	Illuminations	5	4	20	80
	Common course II	HN4A06B18	Gadya Aur Ekanki	5	4	20	80
		FR4A06B18	An Advanced course in French -II				
		MA4A06B18	Malayala Gadhyarachanakal				
	Complementary course I	MT4C01B18	Fourier Series, Partial Differential Equations, Numerical Analysis and Abstract Algebra	5	4	20	80
	Complementary course II	ST4C01B18	Statistical Inference	5	4	20	80
	Core Course PH4	**PH4B04B18**	**Electricity and Electrodynamics PH4B04B18**	3	3	15	60
	Core Practical	**PH4BP02B18**	Core Practical II **Mechanics, Properties of matter and Optics II**	2	2	10	40
Total Credits for Semester IV = 21							

Sem.	Course Type	Course Code	Title of the Course	Hours / week	Credits	Max. Marks	
						ISA	ESA
V	Core Course	**PH5B05B18**	**Environmental PhysicsAnd Human Rights**	4	4	15	60
	Core Course	**PH5B06B18**	**Classical and Quantum Mechanics**	3	3	15	60
	Core Course	**PH5B07B18**	**Physical Optics and Photonics**	3	3	15	60
	Core Course	**PH5B08B18**	**Digital Electronics**	3	3	15	60
	Core Practical	**PH6BP03B18**	Core Practical III **Electricity & Magnetism**	2	*	*	*
	Core Practical	**PH6BP04B18**	Core Practical IV **Electronics and Microprocessor**	2	*	*	*
	Core Practical	**PH6BP05B18**	Core Practical V **Spectroscopy, Laser and Computer Programming**	2	*	*	*
	Core Practical	**PH6BP06B18**	Core Practical VI **Digital and Advanced Electronics**	2	*	*	*
	Open Course	Offered by other depts.	Open course	4	3	20	80
Total Credits for Semester V = 16							

Sem.	Course Type	Course Code	Title of the Course	Hours / week	Credits	Max. Marks	
						ISA	ESA
VI	Core Course	**PH6B09B18**	**Thermal and Statistical Physics**	3	3	15	60
	Core Course	**PH6B10B18**	**Relativity and Spectroscopy**	4	3	15	60
	Core Course	**PH6B11B18**	**Nuclear, Particle and Astrophysics**	3	3	15	60
	Core Course	**PH6B12B18**	**Condensed Matter Physics**	4	3	15	60
	Core Course	**PH6B13*B18**	**Choice Based Course**	3	3	20	80
	Core Practical	**PH6BP03B18**	Core Practical III **Electricity & Magnetism**	2	2	10	40
	Core Practical	**PH6BP04B18**	Core Practical IV **Electronics and Microprocessors**	2	2	10	40
	Core Practical	**PH6BP05B18**	Core Practical V **Spectroscopy, Laser and Computer Programming**	2	2	10	40
	Core Practical	**PH6BP06B18**	Core Practical VI **Digital and Advanced Electronics**	2	2	10	40
	Core	**PH6BPRB18**	**Project**	-	1	20	80
Total Credits for Semester VI = 24							
Total Credits for the programme = 120							

* Two hours will be allotted for Practical for each core course in all semesters. But the practical examination will be conducted on even semesters alone.

SCHEME: CORE COURSES

Course code	Title of the Course	Cate-gory	Hours per week	Credits	Total hours /sem
SEMESTER-1					
PH1B01B18	Methodology and Perspectives of Physics	Core	2	2	36
PH2BP01B18	Core Practical I Mechanics, Properties of matter and Optics I	Core	2	*	36
	Total Credits			**2**	
SEMESTER-2					
PH2B02B18	Mechanics and Properties of Matter	Core	2	2	36
PH2BP01B18	Core Practical I -Mechanics, Properties of matter and Optics I	Core	2	2	36
	Total Credits			**4**	
SEMESTER-3					
PH3B03B18	Electronics	Core	3	3	54
PH4BP02B18	Core Practical II-Mechanics, Properties of matter and Optics II	Core	2	*	36
	Total Credits			**3**	
SEMESTER-4					
PH4B04B18	Electricity and Electrodynamics	Core	3	3	54
PH4BP02B18	Core Practical II-Mechanics, Properties of matter and Optics II	Core	2	2	36
	Total Credits			**5**	
SEMESTER-5					
PH5B05B18	Environmental Physics And Human Rights	Core	4	4	72
PH5B06B18	Classical and Quantum Mechanics	Core	3	3	54
PH5B07B18	Physical Optics and Photonics	Core	3	3	54

PH5B08B18	Digital Electronics	Core	3	3	54
PH6BP03B18	Core Practical III- Electricity & Magnetism	Core	2	*	36
PH6BP04B18	Core Practical IV- Electronics and Microprocessors	Core	2	*	36
PH6BP05B18	Core Practical V- Spectroscopy, Laser and Computer Programming	Core	2	*	36
PH6BP06B18	Core Practical VI- Digital and Advanced Electronics	Core	2	*	36
Offered by other Depts.	Open course		4	3	72
	Total Credits	**16**			
SEMESTER-6					
PH6B09B18	Thermal and Statistical Physics	Core	3	3	54
PH6B10B18	Relativity and Spectroscopy	Core	4	3	72
PH6B11B18	Nuclear, Particle and Astrophysics	Core	3	3	54
PH6B12B18	Condensed Matter Physics	Core	4	3	72
PH6B13*B18	Choice based Course	Core	3	3	54
PH6BP03B18	Core Practical III-Electricity & Magnetism	Core	2	2	36
PH6BP04B18	Core Practical IV-Electronics and Microprocessors	Core	2	2	36
PH6BP05B18	Core Practical V-Spectroscopy, Laser and Computer Programming	Core	2	2	36
PH6BP06B18	Core Practical VI - Digital and Advanced Electronics	Core	2	2	36
PH6BPRB18	Project	Core	*	1	*
	Total Credits	**24**			

* The practical examination will be conducted only in even semesters.

* Project evaluation will be done at the end of sixth semester.

SCHEME: CHOICE BASED COURSES OFFERED BY THE DEPARTMENT

Semester	Course Code	Title of the Course	Hours per week	Credits	Total hours per semester
VI	PH6B13aB18	Nano Science and Nano Technology	3	3	54
	PH6B13bB18	Material Science	3	3	54
	PH6B13cB18	Computational Physics	3	3	54
	PH6B13dB18	Instrumentation	3	3	54
	PH6B13eB18	Astronomy and Astrophysics	3	3	54
	PH6B13fB18	Information Technology	3	3	54

SCHEME: OPEN COURSES OFFERED BY THE DEPARTMENT FOR OTHER DISCIPLINES

Semester	Course Code	Title of the Course	Number of hours per week	Number of credits	Total hours per semester
V	PH5D01aB18	Amateur Astronomy	4	3	72
	PH5D01bB18	Physics in Daily Life	4	3	72
	PH5D01cB18	Computer Hardware and Networking	4	3	72

SCHEME: COMPLEMENTARY COURSES OFFERED BY THE DEPARTMENT

1. Physics for Bachelor's Programme in Mathematics:

Course	Title of the course	Hours per week	Credits	Total Hours / semester
	SEMESTER-1			
PH1C01B18	Properties of Matter & Error Analysis	2	2	36
PH2CP01B18	Practical	2	*	36
	Total Credits		**2**	
	SEMESTER-2			
PH2C01B18	Mechanics and Astrophysics	2	2	36
PH2CP01B18	Practical	2	2	36
	Total Credits		**4**	
	SEMESTER-3			
PH3C01B18	Modern Physics, Basic Electronics and Digital Electronics	3	3	54
PH4CP01B18	Practical	2	*	36
	Total Credits		**3**	
	SEMESTER-4			
PH4C01B18	Physical Optics, Laser Physics and Dielectrics	3	3	54
PH4CP01B18	Practical	2	2	36
	Total Credits		**5**	

* Two hours will be allotted for Practical for each complementary course in all semesters. But the practical examination will be conducted on even semesters alone.

SCHEME: COMPLEMENTARY COURSES OFFERED BY THE DEPARTMENT

2. Physics for Bachelor's Programme in Chemistry:

Course	Title of the course	Hours per week	Credits	Total Hours / semester
	SEMESTER-1			
PH1C02B18	Properties Of Matter & Thermodynamics	2	2	36
PH2CP02B18	Practical	2	*	36
	Total Credits		**2**	
	SEMESTER-2			
PH2C02B18	Mechanics and Crystallography	2	2	36
PH2CP02B18	Practical	2	2	36
	Total Credits		**4**	
	SEMESTER-3			
PH3C02B18	Modern Physics and Basic Electronics	3	3	54
PH4CP02B18	Practical	2	*	36
	Total Credits		**3**	
	SEMESTER-4			
PH4C02B18	Physical Optics , Laser Physics and Superconductivity	3	3	54
PH4CP02B18	Practical	2	2	36
	Total Credits		**5**	

* Two hours will be allotted for Practical for each complementary course in all semesters. But the practical examination will be conducted on even semesters alone.

EXAMINATIONS

The evaluation of each course shall contain two parts such as In-Semester Assessment and End Semester Assessment. The Internal / In-Semester (ISA) and End Semester Assessments (ESA) shall be made using Mark based Grading system based on 7-point scale. The ratio between ISA and ESA shall be 1:4.

I. MARKS DISTRIBUTION FOR EXTERNAL EXAMINATION AND INTERNAL EVALUATION

Marks distribution for external and internal assessments and the components for in semester evaluation with their marks are shown below. The In-Semester evaluation is to be done by continuous assessments on the following components.

a. For courses without practical

- End–Semester Assessment (ESA): 80 marks
- In-Semester Assessment (ISA): 20 marks

ISA components - Theory	**Marks**
Attendance	5
Assignment/Seminar/Viva	5
Test papers (2 x 5)	10
Total	20

Attendance

% of Attendance	**Marks**
>90%	**5**
Between 85 and 90	**4**
Between 80 and 85	**3**
Between 75 and 80	**2**
75 %	**1**
< 75	**0**

b. <u>For courses with practical</u>

- End–Semester Assessment (ESA): 60 marks
- In-Semester Assessment (ISA) : 15 marks

ISA - Theory	**Marks**
Attendance	5
Assignment/Seminar/Viva	2
Test papers (2 x 4)	8
Total	15

c. For Practicalpapers (conducted only at the end of even semesters):

- Marks of ESA: 40
- Marks of ISA : 10

Internal assessment components	**Marks**
Attendance	2
Test paper (1 x 4)	4
Record*	4
Total	10

For practical Minimum of experiments to be done in each paper are 14. Minimum number of experiments for appearing practical examination is 8. Maximum possible number of repetitions must be done to reduce error in a measuring quantity. Do calculation of percentage error for all experiments. The S.I. units must be specified along with the results.

- **Division of internal marks for record (maximum 4 marks)**

No. of Experiments	Marks
14 and above	4
12 & 13	3
10 & 11	2
8, 9 & 10	1
Less than 8	0

Semester	Course Code	Course Title
1 and 2	PH2BP01B18	Mechanics, Properties of matter and Optics I
3 and 4	PH4BP02B18	Mechanics, Properties of matter and Optics II
5 and 6	PH6BP03B18	Electricity & Magnetism
5 and 6	PH6BP04B18	Electronics and Microprocessors
5 and 6	PH6BP05B18	Spectroscopy, Laser and Computer Programming
5 and 6	PH6BP06B18	Digital and Advanced Electronics

d. FOR PROJECTS/ INDUSTRIAL VISIT AND COMPREHENSIVE VIVA-VOCE

All students have to begin working on the project in the area of core course in the **FIFTH** semester and must submit it in the **SIXTH** semester. The project can be done in individually or in groups (not more than three students). The report of the project in duplicate is to be submitted to the department at the sixth semester and are to be produced before the

examiners. External project evaluation and viva / presentation are compulsory and will be conducted at the end of the programme.

An industrial visit is also included in the programme. The entire student must visit an industry during V or VI semester and submit a report in duplicate along with the project report. This industrial visit and the report will be evaluated internally and externally along with the project evaluation.

The ratio of In-Semester to end semester component of the project is 1:4. The mark distribution for assessment of various components is shown below.

- **Marks of end semester assessment (ESA) : 80**

Components: external assessment	**Marks**
Dissertation of project and industrial visit report	(45+5) =50
Viva-Voce on Project and industrial visit	(27+3) = 30
Total	80

- **Marks of In- Semester Assessment (ISA) : 20**

  All the five components of the internal assessment are mandatory.

Components: In-Semester assessment	**Marks**
Punctuality	5
Experimentation/data collection	5
Knowledge	5
Report on Project and industrial visit	5
Total	**20**

- Bonafide reports of the project work and Industrial Visit conducted shall be submitted at the time of examination.

II.ISA - Test Papers

Two internal test- papers are to be attended in each semester for each paper. The evaluations of all components are to be published and are to be acknowledged by the Candidates. All documents of internal assessments are to be kept in the college for two years and shall be made available for verification by the University. The responsibility of evaluating the internal assessment is vested on the teacher(s) who teach the paper.

III.Assignments

Assignments are to be done from 1st to 4th Semesters. At least one assignment should be done in each semester for all papers.

IV.Seminar / Viva

A student shall present a seminar in the 5th semester and appear for Viva- voce in the 6th semester for all papers.

END SEMESTER ASSESSMENT

The End Semester examination of all semesters shall be conducted by the institution on the close of each semester. For reappearance/ improvement, students may appear along with the next batch.

V. Pattern of Questions

Questions shall be set to assess knowledge acquired, application of knowledge in life situations, critical evaluation of knowledge and the ability to synthesize knowledge. The question setter shall ensure that questions covering all skills are set. He/She shall also submit a detailed scheme of evaluation along with the question paper.

A question paper shall be a judicious mix of short answer type, short essay type/ problem solving type and long essay type questions.

For each course the End-semester Assessment is of 3 hours duration. The question paper has 3 parts. Part A contains 12 objective type questions of which 10 are to be answered .Part B contains 9 short essay questions of which 6 are to be answered. Part C has 4 long essay questions of which 2 are to be answered.

Part	No. of Questions	No. of questions to be answered	Marks (for courses with practical)	Marks (for courses without practical)
A (Short Answer type)	12	10	10 x 1 = 10	10 x 2 = 20
B (Short Essay/Problem)	9	6	6 x 5 = 30	6 x 5 = 30
C (Long Essay)	4	2	2 x 10 =20	2 x 15 = 30

VI. Evaluation of Problems

Numerical problems in Physics shall be given marks in the following way:

Correct formula with correct substitution and answer : 5

Correct formula with correct substitution and answer but wrong or no unit. : 4

Correct formula with correct substitution and wrong answer : 3

Formula alone is correct : 2

Any relevant formula : 1

VII. Practical Examinations

The practical examinations for the core and complementary courses are to be conducted at the end of even semesters by the institution. The practical examinations will be evaluated by one external and one internal examiners. One external examiner will be selected from the panel of examiners and one internal examiner will be selected by the department. The score sheet should be sent to the controller of examination soon after the evaluation. Maximum marks for End Semester assessment of practicals will be 40.

A candidate submitting a certified record with a minimum of 8 experiments alone is eligible for appearing the Practical Examination.

Evaluation of Practical Examinations

The scheme of evaluation of the practical examination will be decided by the Board of Examiners.

Student strength for practical examination

The maximum number of students in a batch shall be 15 for each laboratory session.

VIII.COMPUTATION OF CCPA

Grades-

A 7-point scale based on the total percentage of marks (ISA + ESA) for all courses (theory, practical, project)Grade and Grade Point is given to each course based on the percentage of marks obtained as follows:

% of marks	Grade	Grade point
>95	S - Outstanding	10
85 - 95	A^+ - Excellent	9
75 – 85	A - Very good	8
65 - 75	B^+ - Good	7
55 – 65	B - Above average	6
45 – 55	C - Satisfactory	5
35 – 45	D - Pass	4
<35	F - Failure	0
	Ab - Absent	0

PASS CRITERIA:

- A separate minimum of 30% marks each for ISA and ESA (for both theory and practical) and aggregate minimum of 35% is required for a pass in a course.

- For a pass in a programme, a separate minimum of Grade D is required for all the individual courses.
- If a candidate secures F Grade for any one of the courses in a semester / programme, only F grade will be awarded for that semester/programme until she improves this to D Grade or above within the permitted period.
- Students who complete the programme with D grade will have one betterment chance within 12 months, immediately after the publication of the result of the whole programme.

CREDIT POINT AND CREDIT POINT AVERAGE

a) **Credit Point (CP) of a course is calculated as** :

$CP = C \times GPV$

where C = Credit for the course; GP = Grade point

b) Semester Grade Point Average (SGPA) of a semester:

SGPA = TCP/TC

TCP = Total Credit Point of that semester

TC = Total Credit of that semester

c) Cumulative Grade Point Average (CGPA) is calculated:

CGPA = TCP/TC

TCP = Total Credit Point of that programme

TC = Total Credit of that programme

Grades for the different semesters / programme are given based on the corresponding SCPA on a 7-point scale as shown below.

d) Grade Point Average (GPA) of different category of courses viz. Common courses, Complementary courses, Core courses etc. are calculated:

GPA = TCP/TC

TCP = Total Credit Point of a category of course

TC = Total Credit of that category of course

e) Grades for the different courses, semesters and overall programme are given based on the corresponding GPA:

GPA	**Grade**
>9.5	S - Outstanding
8.5 – 9.5	A^+ - Excellent
7.5 – 8.5	A - Very good
6.5 – 7.5	B^+ - Good
5.5 – 6.5	B - Above average
4.5 – 5.5	C - Satisfactory
3.5 – 4.5	D - Pass
<3.5	F - Failure

- **For reappearance/improvement of I, II, III & IV semesters, candidate have to appear along with the next batch.**
- **There will be supplementary exams for V sem in the respective academic year.**
- **Notionally registered candidates can also apply for the said supplementary examinations.**
- **A student who registers her name for the end semester assessment for a semester will be eligible for promotion to the next semester.**

- **A student who has completed the entire curriculum requirement, but could not register for the Semester examination can register notionally, for getting eligibility for promotion to the next semester.**

- **A candidate who has not secured minimum marks/credits in ISA can re-do the same registering along with the ESA for the same semester, subsequently**
- **There shall be no improvement for internal evaluation**

SYLLABI OF COURSES

CORE COURSES

Semester I

PH1B01B18- METHODOLOGY AND PERSPECTIVES OF PHYSICS

Credits – 2

Total lecture hours – 36

Aim

This course will be an introduction to the pursuit of Physics, its history and basic footsteps. The course also aims at emphasizing the importance of number systems and error analysis which is central to physics and will provide a theoretical basis for doing experiments in related areas.

Course Overview and context

Physics is, the oldest and most basic pure science; its discoveries find applications throughout the natural sciences. The course starts with a view on Development of physics in the last century and the birth of new scientific concepts with reference to scientific contributions of various scientists. As we know, no measurement of a physical quantity can be entirely accurate and it is important to have knowledge about the deviations of measured quantity from true value. Brief discussions about how errors are reported, the kinds of errors that can occur, how to estimate random errors, and how to carry error estimates into calculated results are included as a part of this course. Further various experimental methods is also included in this course.

Module I

Concepts and Development of Physics (8hrs)

Development of physics and the birth of new scientific concepts with reference to scientific contributions of Galileo – perspectives on universe, Newton- deterministic universe, Einstein- theory of relativity, J J Thomson – atom model, Marie Curie- radioactivity, Max Plank-

quantum hypothesis, deBroglie- matter wave, Heisenberg- uncertainty principle and Schrodinger- quantum mechanics. Contributions of Indian physicists -C V Raman, H J Babha, J C Bose, S N Bose, M N Saha, S Chandrasekhar (Topics in this part require qualitative study only).

Text Books:

1. *Feynman lectures of Physics*
2. *Concepts of Modern Physics: Arthur Beiser,*
3. *Modern Physics: Kenneth Krane*
4. *Modern Physics: R Murugeshan*
5. *https://www.nobelprize.org/nobel_prizes/physics/laureates/*

Module II

Number systems (18 hrs)

Decimal, hexadecimal and Binary Numbers. Conversions, Binary arithmetic addition, subtraction and multiplication. 1's and 2's complement subtraction –signed binary numbers. Signed binary arithmetic, BCD code, ASCII code, Significance of binary number system in digital electronics, microprocessors and in computers.

Introductory Vector Analysis - Applications of vectors in Physics. Differential and integral vector calculus: – The operator - physical significance of Gradient, Divergence and Curl, Line integral, surface integral and volume integral of vectors.

Co-ordinate systems: Cartesian Co-ordinate system, plane polar and spherical polar coordinates, cylindrical coordinates (Basic ideas with examples in physics).

Text Books:

1. *Introduction to Electrodynamics, David J. Griffiths, Prentice Hall India Pvt. Ltd., Chapter 1*
2. *Mathematical Physics: Charlie Harper*
3. *University Physics, Roger A Freedman, Hugh D Young 14th edition*
4. *Digital electronics: Albert Paul Malvino*
5. *Digital logic and computer design – M. Morris Mano, PHI.*

Module III

Experimental methods and error analysis (10 hrs)

Experimental methods, least count of instruments, Instruments for measuring mass, length, time, angle , current, voltage. Fundamental units. Precision and accuracy of measurements, source of error in measurements, necessity of estimating errors, types of errors, reading error of instrument, calibration error, random error, systematic error, significant digits, order of magnitude and rounding of numbers, rounding error, absolute and relative errors, Errors of computation- addition, subtraction, multiplication, division, error in power and roots, Propagation of errors, analysis of data, standard deviation, calculation of mean value.

Text Books:

1. *Advanced course in Practical Physics by D Chattopadhyay- Chapter-1*
2. *Practical Physics, G L Squires, Third edn. Cambridge University Press.*
3. *The theory of Errors in Physical Measurements- J C Pal- New Central Book Agency-2010*
4. *An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, John R. Taylor - Univ. Science Books*
5. *http://www.upscale.utoronto.ca/PVB/Harrison/ErrorAnalysis/*
6. *http://phys.columbia.edu/~tutorial/index.html*

Competencies:

- Recognize development of physics in the last century.
- Identify contributions of Galileo, Newton, Einstein, J J Thomson, Curies, Rayleigh, Max Plank, Heisenberg and Schrodinger.
- Mention Contributions by S. N. Bose, M. N. Saha, etc .
- Aware of various number systems.
- Summarize Significance of binary number system in digital electronics, microprocessors and in computers.
- Explain applications of vectors in Physics.
- Explain physical significance of Gradient, Divergence and Curl.
- Express Line integral, surface integral and volume integral of vectors.

- Recognize various Co-ordinate systems.
- Explain various experimental methods.
- Generalize necessity of estimating errors.
- Identify Errors of computation.
- Investigate Propagation of errors, analysis of data, standard deviation

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I Semester Core Course

PH1B01B18 METHODOLOGY AND PERSPECTIVES OF PHYSICS

Module	**Hours**	**Marks 1**	**Marks 5**	**Marks 10**	**Total 60**
		10 / 12	**6/9**	**2/4**	
I Concepts and Development of Physics	8	3	2	1	23
II Number systems Introductory Vector Analysis	18	6	3	2	41
III Experimental methods and error analysis	10	3	4	1	33

MODEL QUESTION PAPER

PH1B01B18 Methodology in Physics and Simple Harmonic Motion

First Semester CBCSS Examination

Time: 3 Hours **Maximum Marks: 60**

Part A

(Answer any 10 questions. Each question carries 1 mark)

1. Mention Newton's laws of motion.
2. Write Planck's hypothesis.
3. What is Raman effect?
4. 1's and 2's complement of 1001 is…. and ….
5. What is ASCII code.
6. What will be the magnitude and direction of gradient of a scalar function?
7. When a vector function becomes conservative?
8. The volume integral of density of a substance gives…..
9. Find the volume of sphere?
10. What do you mean by standard deviation?
11. What is the difference between mass and weight?
12. Distinguish between precision and accuracy.

(10 x 1=10 marks)

PART B

(Answer any 6 questions. Each question carries 5 marks)

13. Write briefly about scientific contributions of Einstein?
14. What is Chandrasekhar limit? Give its significance
15. Convert 1010 to its equivalent decimal, 0ctal and hexadecimal numbers?
16. Convert 12.55 to its equivalent binary, octal and hexadecimal numbers?
17. Briefly explain line and surface integrals?
18. A rectangular board is measured with a scale having accuracy of 0.2 cm. The length and breadth are measured as 35.4 cm and 18.5 cm respectively. Find the relative error of the area calculated.

19. Convert the errors in the following measurements of the velocities of two carts on a track into fractional errors and percent errors (a) v= 55 ± 2 cm/s (b) u= -20 ± 2 cm /s. (c) a cart's kinetic energy is measured as 4.58 ± 2%.
20. Explain different types of errors.
21. Two clocks are showing different time at a place. One is sundial and the other is a
22. Quartz clock. Which clock shows correct time? Why?

(6x 5 = 30 marks)

PART C

(Answer any 2 questions. Each question carries 10 marks)

22. Discuss major scientific contributions of any three Indian scientists?
23. Describe the differential operators gradient, divergence and curl and give its physical significance.
24. Write on different Cartesian, Spherical polar and cylindrical co ordinates systems.
25. Discuss the computation of errors in multiplication, division and in powers and roots. Describe the necessity of estimating errors.

(2 x 10 = 20 marks)

Semester II

PH2B02B18 MECHANICS AND PROPERTIES OF MATTER

Credits – 2

Total contact hours – 36

Aim

This course will try to provide conceptual understanding of basic physics to students and will provide a theoretical basis for doing experiments in related areas.

Course Overview

This course exposes students to ideas of wave motion, oscillations, elasticity and hydrodynamics Module I is divided wave motion and oscillations. Module II handles Rotational mechanics. The last module covers elasticity and hydrodynamics. This course altogether imparts knowledge in Mechanics.

Module I (12 hours)

Oscillations (8 hours)

Periodic motion, simple harmonic motion and harmonic oscillator, energy of a harmonic oscillator, examples of harmonic oscillator – simple and compound pendulum. Theory of Damped harmonic oscillator. Theory of forced oscillator, resonance, applications.

Text Book: Mechanics by D.S. Mathur (Revised edition, 2012) – Chapter 7,

8. **Wave motion (4 hours)**

General equation of wave motion, plane progressive harmonic wave, energy density, intensity of a wave, superposition of waves, beats, transverse waves in stretched strings, modes.

Text Book: Mechanics by D.S. Mathur (Revised edition, 2012) – Chapter10.

Module –II (7 Hours)

Rotational mechanics

Angular velocity- angular acceleration- angular momentum- conservation- torque-moment of inertia- Parallel and perpendicular axes theorems - calculation of moment of inertia(rod, ring, disc, cylinder, and sphere). Theory of flywheel.

Text Book: Mechanics by D.S. Mathur (Revised edition, 2012) – Chapter 11.

Module III (17 Hours)

Elasticity (10 hours)

Basic ideas on elasticity – Young's modulus, bulk modulus, rigidity modulus, Poisson's ratio, relations connecting various elastic constants. Work done per unit volume in a strain. Bending of beams, bending moment, flexural rigidity. Young's modulus – uniform and non-uniform bending, cantilever. I –section girders. Determination of rigidity modulus using Static method- static torsion and Dynamic method- torsion pendulum.

Text Book: Mechanics by D.S. Mathur (Revised edition, 2012) – Chapter 13.

Hydrodynamics (7 hours)

Streamline and turbulent flows, coefficient of Viscosity – Determination of viscosity by Poiseuille's method. Equation of continuity, energy possessed by a liquid, Bernoulli's theorem. Surface tension, surface energy, excess pressure in a liquid drop and bubble, factors affecting surface tension, applications.

Text Book: Mechanics by D.S. Mathur (Revised edition, 2012) – Chapter 15.

Text books:

1. *Mechanics by J.C. Upadhayaya, Ramprasad Pub.*
2. *Mechanics -D.S.Mathur, S.Chand.*
3. *Advanced course in Practical Physics by D Chattopadhyay, Central Book*
4. *Properties of Matter and Acoustics by Murugeshan and K. Sivaprasath, S. Chand*

References:

1. Mechanics- Hans and Puri, TMH

2. Classical Mechanics by J.C. Upadhyaya, Himalaya Pub.

3. Classical Mechanics-Takwale and Puranik, TMH.

4. Classical mechanics- K.SankaraRao, PHI.

5. Properties of Matter by Mathur, S. Chand,

6. Mechanics by SomnathDatta, Pearson

7. Mechanics by H.D Young and R.A Freedman, Pearson.

Competencies:

- Classify types of waves
- Recognize wavelength, frequency and wave number
- Obtain the equation for a plane progressive harmonic wave
- Explain distribution of energy in a plane progressive wave
- Define Periodic motion and simple harmonic motion.
- Elaborate theory of Damped and forced harmonic oscillator.
- Understand resonance
- Mention applications of oscillations.
- Distinguish translational and rotational motion
- Mention torque, angular momentum, angular impulse
- Define moment of inertia and radius of gyration
- State and prove parallel and perpendicular theorems
- Determine the moment of inertia of different shapes specifically uniform rod etc.
- Compute total energy of a rolling body
- Determine experimentally moment of inertia of a flywheel .
- Define Poisson's ratio
- Define twisting couple on a cylinder, angle of twist and angle of shear
- Identify bending moment,
- Discuss the cases of bending of beams in cantilever, centrally loaded supported
- State Newton's law of viscous flow
- Distinguish stream line and turbulent flow
- Define Critical velocity,
- State the significance of Reynold's Number
- Derive Poiseuille's equation for a liquid flowing through a narrow tube
- Illustrate the calculation of coefficient of viscosity of a viscous liquid
- Explain Surface tension & Surface energy.
- Determine excess pressure in a liquid drop and bubble.
- Examine factors affecting surface tension, applications.

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II Semester Core Course

PH2B02B18 MECHANICS AND PROPERTIES OF MATTER

Module	**Hours**	**Marks 1**	**Marks 5**	**Marks 10**	**Total 60**
		10 / 12	**6/9**	**2/4**	
I Wave motion Oscillations	12 (4+8)	4	2	2	34
II Rotational mechanics	7	2	2	1	22
III Elasticity Hydrodynamics	17 (10+7)	6	5	1	41

Semester III

PH3B03B18 - SEMICONDUCTOR PHYSICS

Credits- 3

Total lecture hours- 54

Aim:

It is impossible to live in the present world without using electronic devices. Even in daily life, there are instances where we should have at least a basic understanding of the working of various electronic devices and the properties of electrical circuits. The electronics course is intended to give the students this basic knowledge

Course overview and context:

The students already have the required basic knowledge of semiconductors and pn junction diodes. The course starts with a revision of these fundamentals and extends it to the applications of diodes in constructing DC voltage sources, voltage multipliers, regulators and wave shaping circuits. The course proceeds to the characteristics of transistors and their applications in constructing various amplifiers. Operational amplifiers, modulators and demodulators are also included.

Module I (14 hours)

Semiconducting diodes and applications

PN Junction, Depletion layer, Barrier potential, Biasing- forward and reverse, Reverse breakdown, Junction capacitance and diffusion capacitance- PN Junction diode – V-I characteristics–Diode parameters, Diode current Equation, Diode testing, Ideal diode. Zener diode and its reverse characteristics. Thermistors. Rectification - Half wave, Full wave, Centre tapped, Bridge rectifier circuits - Nature of rectified output, Efficiency & Ripple factor-Filter circuits – Inductor Filter, Capacitor Filter, LC Filter, π Filter-Regulated Power supplies - Zener diode voltage regulator Voltage multipliers – Doubler & Tripler- Wave shaping circuits - Clipper-Positive, negative and biased – Clampers- Positive, negative and biased.

Text Books:

1. *Basic Electronics- B.L.Theraja Chapters 13,14,15,17*
2. *A Text Book of Applied Electronics- R.S.Sedha Chapters-11, 12, 19, 20, 33*

Module II (24 hours)

Transistors Configurations and Feed back (12 hours)

Bipolar junction transistors, Transistor biasing, CB, CC, CE configurations and their characteristics- Active, saturation and cut-off regions. Current gain α, β, γ and their relationships. Leakage currents- Thermal runaway. DC operating point and AC and DC Load line, Q-Point. Basic principles of feedback, positive & negative feedback, Advantages of negative feedback, negative feedback circuits – voltage series & shunt, current series & shunt.

Amplifiers and Oscillators (12 hours)

Need for biasing-Stabilization- Voltage divider bias. Single stage transistor Amplifiers-CE amplifier - amplification factors. Decibel system, Variations in Amplifier gain with frequency. Oscillatory Circuits, LC oscillators – Hartley Oscillator, Colpit's Oscillator, RC oscillators - Phase shift Oscillator. Astable and monostablemultivibrator (basic idea only)

Text Books:

1. *Basic Electronics-B.L.Theraja-Chapters 18, 19, 20, 22, 24, 25, 28, 29.*
2. *A Text Book of Applied Electronics-R.S.Sedha Chapters 14, 15, 22,24, 29, 31, 32*

Module III

FET, Operational Amplifier & Modulation (16 hours)

FET -characteristics, FET- Parameters. Comparison between FET and BJT.MOSFET (basic idea only) OP-amp- Symbol and terminals. Characteristics of ideal OP-amp, CMRR, Applications - inverting, Non-inverting, Unity follower and Summing amplifiers. Types of modulation – AM, FM, Pulse modulation and Phase modulation (qualitative study only). Amplitude modulation- modulation index - Analysis of AM wave – Sidebands –bandwidth-AM Demodulation.

Text Books:

1. *Basic Electronics-B. L. Theraja - Chapters 26, 30, 31*
2. *A Text Book of Applied Electronics-R.S.Sedha-Chapter-16, 35*

References:

1. *Principles of electronics, VK Mehta, S Chand*
2. *Basic Electronics(7thEdition), Malvino and Bates, TMH*
3. *Electronics Fundamentals and Applications- D. Chattopadhyay and P.G.Rakshit, New Age International Publishers.*
4. *Electronics: Fundamentals of Analog circuits, Thomas L. Floyd, David Buchla, Prentice Hall*
5. *Electronic Devices and Circuit Theory, Robert Boylestad, Louis Nashelsky, Prentice Hall*
6. *Basic Electronics, DebashisDe, Pearson 2010*
7. *Basic Electronics, SantiramKal, PHI 2010*

Competencies:

- Set up circuits to study forward and reverse characteristics of a diode.
- Identify zener and ordinary diodes by performing experiments or from available data sheets.
- Find out various diode parameters from elementary equations.
- Construct circuits for HWR and FWR and explain their working.
- Compare various features of HWR and FWR and calculate various parameters from basic equations.
- Explain the working of various filter circuits.
- Design zener diode voltage regulator.
- Understand the concept of voltage regulation.
- For a given input wave, plot the outputs obtained from various types of clippers and clampers.
- Design biased clippers and clampers according to a given requirement.
- Explain the working of wave shaping circuits.
- Explain the working of voltage doublers.

- Explain Mechanism of transistor action
- Illustrate the working of transistor as an amplifier
- Identify the transistor currents and state relation between transistor currents
- Explain transistor circuit configurations–CB, CE and CC configurations
- Compare CB, CE and CC configurations and draw their characteristics
- Describe the experiments to draw transistor characteristics
- Define current gains in CE, CB and CC and determine relation between current gains in them
- Define leakage currents in CB and CE
- Explain thermal runaway.
- Draw Load line in transistor characteristics
- Define Q- point
- Describe the relevance of Q point in transistor biasing to get maximum undistorted output
- Describe the need for biasing transistors
- Discuss the factors affecting Bias variations
- Define Stability factor and Beta sensitivity
- Determine Stability factor for CB and CE circuits
- Describe Methods for transistor biasing- Base Bias, Base bias with emitter feedback, Base bias with collector feedback and voltage divider bias
- Find stability factor for each biasing methods.
- Define h parameters
- Describe the hybrid equivalent circuit of common base and common emitter configurations
- Compute amplifier expressions in terms of h parameters
- Classify and compare amplifiers, CB, CE and CC amplifiers
- Classify and compare power amplifiers based on biasing condition - Class A, B,C and Class AB amplifiers
- Explain the working of AM diode detector with circuit diagram.
- Describe feedback concept.
- Draw the circuit diagram of negative voltage feedback amplifier, discuss its working

and determine the voltage gain.

- Mention the advantages of negative voltage feedback amplifiers.
- Draw the circuit of negative current feedback amplifier, discuss its working and determine the current gain.
- Mention the effects of negative current feedback amplifiers.
- Apply negative current feedback in transistor circuit (emitter follower), draw its circuit diagram and describe its working only.
- Mention the applications of emitter follower.
- Classify different types of oscillators.
- Discuss Barkhausen criterion.
- Explain the working of LC tank circuit.
- List Different types of transistor oscillators.
- Draw the circuit diagram of Tuned collector oscillator and explain its working.
- Draw the circuit diagram of Colpitt's oscillator and explain its working.
- Draw the circuit diagram of Hartley oscillator and explain its working
- Draw the circuit diagram of Phase Shift oscillator and explain its working
- Classify different types of multivibrators.
- Explain the working of Transistor astable multivibrator with circuit diagram.
- Explain the working of Transistor monostable multivibrator with circuit diagram.
- Explain the working of Transistor bistable multivibrator with circuit diagram.
- Understand FET.
- Compare FET with BJT.
- Learn FET parameters.
- Understand the working of MOSFET.
- Compare FET with MOSFET.
- Compare the properties of ideal and real operational amplifier.
- Explain the concept of virtual ground and summing point in operational amplifier.
- Explain the working of inverting amplifier with circuit diagram, determine its voltage
- gain, input impedence, output resistance and common mode rejection ratio.
- Explain the working of inverting amplifier with circuit diagram, determine its voltage
- gain, input impedence, output resistance and common mode rejection ratio.

- Explain the working of Transistor astable multivibrator with circuit diagram.
- Explain the working of unity follower with circuit diagram.
- Explain the working of summing amplifier with circuit diagram.
- Explain the necessity of modulation in wireless communication system
- Classify different types of modulation.
- Explain the principle of amplitude modulation, define modulation index, analyse the
- amplitude modulated wave and describe the occurrence of sidebands.
- Calculate power of amplitude modulated wave.
- Explain the working of Transistor AM modulator with circuit diagram.
- Mention the limitations of amplitude modulation.
- Explain the principle of frequency modulation.
- Describe demodulation.

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III Semester Core Course

PH3B03B18- SEMICONDUCTOR PHYSICS

Module	**Hours** **54**	**Marks** **1** **10/ 12**	**Marks** **5** **6/9**	**Marks** **10** **2/4**	**Total** **60**
I Semiconducting diodes and applications	14	3	2	1	23
II Transistors Configurations and Feed back Amplifiers and Oscillators	24	6	4	2	46
III FET, Operational Amplifier & Modulation	16	3	3	1	28

Semester IV

PH4B04B18 - ELECTRICITY AND ELECTRODYNAMICS

Credits - 3

Total lecture hours- 54hrs

Aim

Electricity and electrodynamics plays an important role in the development of technology. Needless to say without electric power and communication facilities, life will become difficult. It's for this reason that a course in electricity and electrodynamics is essential part of physics education at graduate level. This course is designed to provide a strong foundation in electricity and electrodynamics.

Course overview and context

This course envisages to cover behavior of DC currents in series combination active and passive elements, theory of Ballistic galvanometer and experiments, LCR series and parallel circuits, network theorems, electrostatics, magnetostatics and electrodynamics.

Module I (18 hours)

Transient Current (9 hrs)

Growth of current in a circuit containing a resistance and inductance - Decay of current in a circuit containing a resistance and inductance - Charge and discharge of a capacitor through a resistor - Measurement of high resistance by leakage - Growth of charge in a circuit with inductance, capacitance and resistance- Discharge of a capacitor through an inductor and a resistor in series - Moving coil ballistic galvanometer - Current and voltage sensitivities of a moving-coil galvanometer - Measurement of charge sensitiveness - Absolute capacitance of a capacitor.

Text book -

Electricity & Magnetism – R.Murugeshan- Ninth revised edition- reprint 2013 Publications-S Chand & Company PVT-LTD, Ram Nagar, New Delhi – 110055. Chapter12 & Chapter 10 – Sections 10.11 to 10.15

Alternating Current and Network Theorems (9hrs)

EMF induced in a coil rotating in magnetic field- AC circuit containing resistance-inductance and capacitance in series (Series resonance circuit)- Parallel resonant circuit-Power in ac circuit containing resistance- inductance and capacitance- Wattless current-Choke coil- Skin effect- Three phase ac generator- Distribution of three phase alternating current- The ac watt meter

Network Theorem

Ideal current source- Ideal voltage source- Superposition theorem- Reciprocity theorem- Thevenin's theorem- Norton's theorem- Maximum power transfer theorem

Text book –-

Electricity & Magnetism – R.Murugeshan- Ninth revised edition- reprint 2013- Publications- S *Chand & Company PVT-LTD, Ram Nagar, New Delhi –* 110055.*Chapter13- Sections 13,14, 30 and18*

Module II (18 hours)

Electrostatics & Magnetostatics (18 hrs)

Electric field - Continuous charge distribution - Divergence and curl of electrostatic fields - Gauss' Law and its application to obtain fields due to Spherically symmetric charge distribution, Uniformly charged spherical conductor, Line charge, Infinite plane sheet of charge & Electric field at a point between two oppositely charged parallel plates. Electric potential- Poisson's equation and Laplace's equation- The potential of a localized charge distribution- Work and Energy in electrostatics- The work done to move a charge- Energy of a point charge distribution and continuous charge distribution. Conductors: Basic properties- induced charges- Surface charge and force on a conductor- Capacitors.

Magnetic field of Steady currents: - Biot Savart's law - magnetic induction at a point due to a straight conductor, axis of a circular coil & at the axis of a solenoid - Force on a current carrying conductor in magnetic field - force between two parallel conductors carrying current- electron moving in a magnetic field and Lorentz force- Ampere's circuital law - differential form - applications - to find the magnetic fields due to long solenoid & toroid- Comparison of magnetostatics and electrostatics

Text book -

Electricity& Magnetism – R. Murugeshan- Ninth revised edition- reprint 2013 Publications- S Chand & Company PVT-LTD, Ram Nagar, New Delhi – 110055

Module III (18 hours)

Maxwell's equations and Electromagnetic waves

Maxwell's equations- Electrodynamics before Maxwell- Modification of Ampere circuital law- Magnetic Charge-Poynting's theorem The wave equation in one dimension- Boundary condition -Reflection and Transmission- Polarization- Electromagnetic waves in vacuum- Monochromatic plane waves- Energy and momentum in Electromagnetic waves- Electromagnetic waves in matter- Propagation in linear media- Electromagnetic waves in conductors

Text book -

Chapter7,8 & 9 - Sections 7.3, 8.1, 9.1 to 9.3.1 and 9.4.1 Introduction to Electrodynamics - David J Griffiths Publications- Prentice Hall -Inc(Pearson Education- Inc)

Reference:

1. *Electricity and Magnetism – J-H-Fewkes & JohnYarwood, University tutorial*
2. *Fundaments of Magnetism and Electricity D N Vasudeva - S chand*
3. *Electricity and Magnetism A S Mahajan and AA Rangwala -TMH*
4. *Introduction to electrodynamics- David J Griffiths- PHI*
5. *Electromagnetics Matthew N Sadiku- Oxford 4th Edn*
6. *Electromagnetics with applications Kraus/Fleish 5th Edn – TMH*
7. *Electromagnetics J A Edminister 2nd Edn - TMH*
8. *Electromagnetic Fields TVS Arunmurthi – S- Chand*

Competencies:

- Set up circuits to study forward and reverse characteristics of a diode.
- Identify zener and ordinary diodes by performing experiments or from available data

sheets.

- Find out various diode parameters from elementary equations.
- Construct circuits for HWR and FWR and explain their working.
- Compare various features of HWR and FWR and calculate various parameters from basic equations.
- Explain the working of various filter circuits.
- Design zener diode voltage regulator.
- Understand the concept of voltage regulation.
- For a given input wave, plot the outputs obtained from various types of clippers and clampers.
- Design biased clippers and clampers according to a given requirement.
- Explain the working of wave shaping circuits.
- Explain the working of voltage doublers.
- Discuss varying current.
- State Kirchhoff's law for varying current.
- Explain the growth and decay of current in LR circuit.
- Explain the charging and discharging of a capacitor through resistor.
- Discuss the method to determine high resistance by leakage.
- Explain the charging and discharging of a capacitor through resistor and inductor in series.
- Discuss the theory of moving coil ballistic galvanometer.
- Mention logarithmic decrement and Define voltage and current sensitivities
- Design experiments to measure the capacitance of a given capacitor using ballistic galvanometer and charge sensitivity of ballistic galvanometer using a standard capacitor
- Discuss variation of alternating current with time and define basic parameters and Determine mean value and rms values of ac.
- Explain the phase relationship between alternating voltage and current in LCR series circuit and Calculate power in an LCR series circuit.
- Explain the phase relationship between alternating voltage and current in LCR parallel circuit

- Explain skin effect.
- Discuss three phase distribution
- Explain the working of ac watt meter.
- State and prove Superposition, Reciprocity, Thevenin's, Norton's & Maximum power transfer theorems.
- Discuss the Propagation of electromagnetic waves in linear Media.
- Describe the propagation of electromagnetic waves in conductors
- State and arrive at Maxwell's equations.
- Describe Electrodynamics before Maxwell
- Explain how Ampere circuital law is modified by Maxwell.
- Determine Maxwell's equations in matter.
- Find the Boundary conditions for electric and magnetic Fields between two media.
- State and prove Poynting's theorem.
- C37. Apply Poynting's theorem to find energy propagated, electric field or magnetic field in the given electromagnetic field.
- C38. Derive the general wave equation in one dimension.
- C39. Find the Boundary condition under Reflection and Transmission.
- C40. Discuss the Polarization of Electromagnetic waves.
- C41. Derive the wave equation for electromagnetic waves in vacuum.
- C42. Describe Monochromatic plane waves.
- C43. Get the expressions for Energy and Momentum in Electromagnetic waves.
- C44. Discuss the propagation of electromagnetic waves in vacuum and describe the notion of skin depth, frequency, wavelength and velocity.

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IV Semester Core Course

PH4B04B18 - ELECTRICITY AND ELECTRODYNAMICS

Module	**Hours** **54**	**Marks** **1** **10 / 12**	**Marks** **5** **6/9**	**Marks** **10** **2/4**	**Total** **60**
I Transient current, AlternatingCurrent, Network Theorems	18	4	3	2	39
II Electrostatics &Magnetostatics	18	4	3	1	29
III Maxwell's equations and Electromagnetic waves	18	4	3	1	29

Semester V

PH5B05B18 - ENVIRONMENTAL PHYSICS AND HUMAN RIGHTS

Credits -4

Total Lecture hours- 72

Aim

The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. It is clear that no citizen of the earth can afford to be ignorant of environment issues.

Intellectual property rights (IPRs) have become important in a biodiversity-rich country like India to protect microbes, plants and animals that have useful genetic properties. Destruction of habitats, over-use of energy resource and environmental pollution has been found to be responsible for the loss of a large number of life-forms. It is feared that a large proportion of life on earth may get wiped out in the near future. In spite of the deteriorating status of the environment, study of environment has so far not received adequate attention in our academic programme.

Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment at every level in college education. Accordingly, the matter was considered by UGC and it was decided that a six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the University/Colleges of India.

The syllabus of environmental studies includes five modules including human rights. The first two modules are purely environmental studies according to the UGC directions. The second two modules are strictly related with the core subject and fifth module is for human rights.

Course overview and Context

Environmental Education encourages students to research, investigate why things happen, and make their own decisions about complex environmental issues by developing and

enhancing critical and creative thinking skills. It helps to foster a new generation of informed consumers, workers, as well as policy or decision makers.

Environmental Education helps students to understand how their actions affect the environment, builds knowledge and skills necessary to address complex environmental issues, as well as ways we can take action to keep our environment healthy and sustainable for the future. It encourages character building, and develops positive attitudes and values.

The topics incorporated are to develop the sense of awareness among the students about the environment and its various problems and to help the students in realizing the inter-relationship between man and environment and helps to protect the nature and natural resources.

Module I (18 hours)

Multidisciplinary nature of environmental studies(2 hours)

Definition, scope and importance, Need for public awareness.

Natural Resources(10 hours)

Renewable and non-renewable resources: Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification

- Role of individual in conservation of natural resources.

- Equitable use of resources for sustainable life styles.

Ecosystems (6 hours)

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the given
- ecosystem:- Forest ecosystem

Module II (26 hours)

Biodiversity and its conservation (8 hours)

- Introduction
- Biogeograhical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- India as a mega-diversity nation
- Hot-sports of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
- Endangered and endemic species of India

Environmental Pollution (8 hours)

- Definition, Causes, effects and control measures of: -
  a. Air pollution
  b. Water pollution
  c. Soil pollution
  d. Marine pollution
  e. Noise pollution
  f. Thermal pollution

g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides.

Social Issues and the Environment (10 hours)

- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people: its problems and concerns, Case studies
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust, Case studies
- Consumerism and waste products
- Environment Protection Act
- Air (Prevention and Control of Pollution) Act
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness

Module III

Non-renewable and Renewable Energy Sources (10 hours)

Non-renewable energy sources:-Coal, Oil, Natural gas; Nuclear fission energy; Merits and demerits of non-renewable energy. Renewable energy sources: Biomass energy- Biogas plant - Fixed dome type and moving dome type; Wind energy; Wave energy; Tidal energy; Hydroelectricity; Geothermal energy conversion; Ocean thermal energy conversion; Fusion energy; Hydrogen energy- Production (electrolysis) and storage; Merits and demerits of each

renewable energy sources; Storage of intermittently generated renewable energy (qualitative); Fuel cell.

Module IV

Solar energy (10 hours)

Sun as a source of energy- Solar radiation, Solar Constant, Spectral distribution; Solar pond - convective and salt gradient types; Flat plate collector; Solar water heater – Direct and indirect systems- Passive and active systems; Optical concentrator – Parabolic trough reflector - Mirror strip reflector - Fresnel lens collector; Solar desalination; Solar dryer - Direct and indirect type; Solar cooker; Solar heating of buildings; Solar green houses; Need and characteristics of photovoltaic (PV) systems; Solar cells - Principle, Equivalent circuits, V-I characteristics, fill factor, conversion efficiency; PV Sun tracking systems; Merits and demerits of solar energy.

Module – V (8 hours)

Human Rights

An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

Human Rights and United Nations

Contributions, main human rights related organs - UNESCO, UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights. Human Rights in India – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Environment and Human Rights

Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment conservation of natural resources and human rights: Reports, Case studies and policy formulation. Conservation issues of western ghats- mention Gadgil committee report, Kasthurirengan report. Over exploitation of ground water resources,marine fisheries, sand mining etc.

Internal:

Field study

- Visit to a local area to document environmental grassland/ hill /mountain
- B Sc Programme in Physics, Mahatma Gandhi University 46
- Curriculum and syllabus 2017 admissions onwards
- Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc
- Study of simple ecosystem-pond, river, hill slopes, etc
- (Field work Equal to 5 lecture hours)

Text Books

Environmental study

1. *Bharucha Erach, Text Book of Environmental Studies for undergraduate Courses. University Press, IInd Edition 2013 (TB)*
2. *Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)*
3. *Rajagopalan. R, Environmental Studies from crisis and cure, Oxford University Press, Published: 2016 (TB)*

Human Rights

1. *AmartyaSen, The Idea Justice, New Delhi: Penguin Books, 2009.*
2. *Chatrath, K. J.S., (ed.), Education for Human Rights and Democracy (Shimla: Indian Institute of Advanced Studies, 1998)*
3. *Law Relating to Human Rights, Asia Law House, 2001.*
4. *Shireesh Pal Singh, Human Rights Education in 21st Century, Discovery Publishing House Pvt.Ltd, New Delhi,*
5. *S.K.Khanna, Children and the Human Rights, Common Wealth Publishers, 1998. 2011.*
6. *Sudhir Kapoor, Human Rights in 21st Century, Mangal Deep Publications, Jaipur, 2001.*
8. *United Nations Development Programme, Human Development Report 2004: Cultural Liberty in Today's Diverse World, New Delhi: Oxford University Press, 2004.*

References

1. *Renewable Energy Sources and Emerging Technologies: Edition 2, D.P. Kothari K. C. Singal RakeshRanjan - PHI Learning Pvt. Ltd, 2011.*

2. *Solar energy - M P Agarwal - S Chand and Co. Ltd.*
3. *Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.*
4. *Clark.R.S., Marine Pollution, Clanderson Press Oxford*
5. *Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001 Environmental Encyclopedia, Jaico Publ. House. Mumbai. 1196p*
6. *Dc A.K.Enviornmental Chemistry, Wiley Eastern Ltd*
7. *Down to Earth, Centre for Science and Environment*
8. *Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press 1140pb*
9. *Jadhav.H & Bhosale.V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p*
10. *Mekinney, M.L & Schock.R.M. 1996 Environmental Science Systems & Solutions. Web enhanced edition 639p*
11. *Odum.E.P 1971. Fundamentals of Ecology. W.B. Saunders Co. USA 574p*
12. *Rao.M.N & Datta.A.K. 1987 Waste Water treatment Oxford & IBII Publication Co.Pvt.Ltd.345p*
13. *Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut*
14. *Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science*
15. *Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances AndStadards, Vol I and II, Enviro Media*
16. *Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication*
17. *Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p*

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Semester V Core course

PH5B05B18 - ENVIRONMENTAL PHYSICS AND HUMAN RIGHTS

Module	Hours 72	Marks 1 10 / 12	Marks 5 6/9	Marks 10 2/4	Total 60
I Multidisciplinary nature of environmental studies, Natural Resources, Ecosystems	18	2	2	1	23
II Biodiversity and its conservation, Environmental Pollution, Social Issues and the Environment	26	2	3	1	27
III Non-renewable and Renewable Energy Sources waves	10	2	1	1	17
IV Solar energy	10	2	1	1	17
V Human Rights–Human Rights and United Nations, Environment and Human Rights	8	3	2		13

Semester V

PH5B06B18 - Classical and Quantum Mechanics

Credits -3

Total lecture hours – 54

Aim

The course gives an introduction to techniques in classical mechanics as an alternative to Newtonian mechanics. Since the branches of science in the micro level are governed by principles of quantum mechanics, this course provides a platform for better understanding of various phenomena observed in the nuclear, atomic and molecular world.

Course overview and context

Classical and quantum mechanics remains indispensable part of physics education. They have a two-fold role in preparing the student for the study of modern physics. The first module gives formulations of Lagrangian and Hamiltonian. The second module deals with wave mechanical formulations and the theories that demanded quantum mechanical concepts. Third module introduces the general formalism of quantum mechanics and energy eigen value problems.

Module 1

Lagrangian and Hamiltonian Dynamics (18 hours)

Degrees of freedom, Constraints- holonomic, nonholonomic, rheonomous, scleronmous constraints, Generalized coordinates, Principle of virtual work, D' Alembert's principle, Lagrange's equation from D' Alembert's principle, Applications -Simple pendulum, Atwood's machine, Motion under central force. Hamilton's principle and Lagrange's equations, Merits of Lagrange's equation over Newtonian approach. Calculus of variations and Euler Lagrange's equations- Applications- Shortest distance between two points, Brachistochrone problem.

Generalized momentum and cyclic coordinates, Hamilton's equations, Examples in Hamiltonian Dynamics- Applications-one dimensional Harmonic oscillator, Simple pendulum.

Text Book :Classical mechanics, J C Upadhyaya, Himalaya Publishing house, Chapters 2 & 3

Module II (16 hours)

Quantum mechanics

Origin of Quantum theory (10 hrs)

Limitations of classical physics, black body radiation, Planck's quantum hypothesis, particle nature of radiation, photoelectric effect, Rutherford planetary model, Bohr postulates, the Bohr atom, Compton effect, Stern and Gerlach experiment.

Text Books

1. *Quantum Physics – Stephen Gasirowicz Wiley –India Edition, Chapter 1*
2. *Quantum Mechanics- G.Aruldhas, PHI Learning Private Limited, Chapter 1*

Wave Mechanical Concepts (6hrs)

Wave nature of matter, de Broglie hypothesis, uncertainty principle – single slit experiment, uncertainty relations for other variables, applications of uncertainty relations, principle of superposition, wave packet, particle velocity and group velocity

Text Book: Quantum Mechanics, G.Aruldhas, PHI Learning Private Limited,Chapter2

Module III (20 hours)

General formalism of Quantum Mechanics (14 hrs)

Time dependant Schrodinger equation for free particle and for particle in a field, Interpretation of wave function, probability interpretation, probability current density, expectation value, Ehrenfest's theorem , time independent Schrodinger equation, stationary states, admissibility conditions on the wave function, Operators, linear operators, the commutator, general Eigen value equation, Hermitian operator, postulates of quantum mechanics, simultaneous measurability of observables

Text Book: Quantum Mechanics, G.Aruldhas, PHI Learning Private Limited,Chapter2&3

One dimensional Energy Eigen value Problems (6 hrs)

Particle in a box (square well potential with rigid walls), alpha emission, linear harmonic oscillator Schrodinger method (basic ideas only), zero point energy

Text Book: Quantum Mechanics- G.Aruldhas, PHI Learning Private Limited, Chapter 4

References:

1. *Classical Mechanics, Herbert Goldstein, Charles Poole and John Safk, Pearson Education, Indian Edition.*
2. *Mechanics, H S Hans, S P Puri, Tata McGraw Hill Education Pvt. Ltd.*
3. *Classical Mechanics, Rana and Joag, TMH.*
4. *Classical Mechanics, K. Sankara Rao, Prentice Hall of India.*
5. *Classical Mechanics, Greiner, Springer.*
6. *Concepts of Modern Physics - Arthur Beiser, Tata McGraw Hill.*
7. *A Text book of Quantum Mechanics, P.M. Mathews and S.Venkatesan, TMH.*
8. *A text book of Quantum Mechanics, Ghatak and Lokanathan.*
9. *Feynman lecture series –volume 3.*
10. *Modern Physics -G. Aruldhas, P. Rajagopal, PHI Learning Pvt. Ltd.*

Competencies:

- Define degrees of freedom.
- Elaborate the role of constraints in equations of motion.
- Classify Constraints.
- Describe generalized coordinates.
- State principle of virtual work.
- Explain D' Alembert's principle.
- Derive Lagrange's equation from D' Alembert's principle
- Find the Lagrange's equation of motion for Simple pendulum
- Describe Atwood's machine in terms of its Lagrange's equations

- Extend the Lagrange's equation of motion to represent motion under central force.
- Outline Hamilton's principle to derive Lagrange's equations
- Recognize the merits of Lagrange's equation over Newtonian approach
- Define generalized momentum and cyclic coordinates
- Illustrate Hamilton's equations
- Extend Hamiltonian Dynamics to explain one dimensional Harmonic oscillator
- Apply Hamilton's principle to describe Simple pendulum.
- Illustrate Calculus of variations to find out Euler Lagrange's equations
- Extend the method of calculus of variations to find shortest distance between two points
- Explain Brachistochrone problem using the method of calculus of variations.
- Summarize the limitations of classical mechanics through photoelectric effect and Compton Effect.
- State the Bohr postulates
- Describe Stern & Gerlach Experiment
- Explain uncertainty principle
- Express the concept of wave packet
- Clarify particle velocity and group velocity
- Set up the time dependent Schrodinger equation for wave function give its Interpretation
- Give the interpretation of wave function and probability current density
- Explain the notion of expectation value
- Illustrate and establish Ehrenfest's theorem
- Obtain the time independent Schrodinger equation
- Identify the operators associated with coordinate, energy, momentum
- State the postulates of quantum mechanics
- Solve time dependent Schrodinger equation for specific cases like particle in a box, Square potential barrier
- Express the concept of zero point energy of a harmonic oscillator.

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V Semester Core Course

PH5B06B18 Classical and Quantum Mechanics

Module	**Hours** **54**	**Marks** **1** **10/ 12**	**Marks** **5** **6 / 9**	**Marks** **10** **2/4**	**Total** **60**
I Lagrangian and Hamiltonian Dynamics	18	4	3	1	29
II Origin of Quantum theory and Wave mechanical concepts	16	4	3	1	29
III General formalism of Quantum mechanics and the Energy eigen value problems	20	4	3	2	39

Semester V

PH5B07B18 – Physical Optics and Photonics

Credits - 3

Total Lecture Hours - 54 hrs

Aim

This course aims to provide necessary foundation in optics and photonics. Further this course will provide a platform for an extensive study of advanced topics at a later stage.

Course Overview

This course covers delivers basic idea of wave optics and deals different optical phenomena such as interference, diffraction and polarization in detail. A good knowledge of optics is essential for the understanding of developments of Photonics further, this course incorporate topics such as lasers, Fibre Optics and Optical Communication.

Module I(22 hours)

Wave optics (Basic ideas) (1hr)

Nature of light- theories of light- EM nature of light. Wavefront- propagation of wavefront. Characteristics of a wave- mathematical representation of a travelling wave.

Text Book: *Optics - Subramanayam, Brijlal, M. N Avadhanalu, S.Chand, Revised 24thEditionChapter 1 (Sec. 1.2-1.3) &Chapter 12 (Sec. 12.1-12.6)*

Interference (10hrs)

Review of basic ideas of interference – optical path – phase difference - coherence- superposition of waves- condition for bright and dark fringes. Interference (Analytical method) - intensity distribution. Techniques of obtaining interference- wavefront splitting- Fresnel's biprism-theory- fringe width- lateral displacement of fringes. Amplitude splitting- Interference in thin films-plane parallel film (reflected system)-conditions for brightness and darkness-Fizeau and Haidinger fringes- Air wedge- theory-determination of wedge angle and thickness of spacer- colours in thin films. Newton's rings(reflected system)-determination of wavelength of light-refractive index of liquid. Michelson interferometer-principle-construction-working (formation of fringes- qualitative ideas)- applications-determination of wavelength- thickness of thin transparent sheet-refractive index of gases.

Text Book: *Optics - Subramanayam, Brijlal, M. N Avadhanalu, S.Chand, Revised 24th EditionChapter 14 (Sec.14.1 – 14.4.2, 14.8, 14.9 – 14.9.4) and Chapter 15 (Sec. 15.1 – 15.2.5, 15.4- 16.6.9, 15.7, 15.8)*

Diffraction (11 hrs)

Fresnel Diffraction

Huygens- Fresnel theory –Fresnel assumptions- Fresnel half period zones-theory of rectilinear propagation- zone plate – action of zone platefor an incident spherical wavefront-comparison between zone plate and convex lens. Diffraction pattern due to a straight edge – intensity at a point in the geometrical shadow.

Fraunhoffer diffraction (calculus method not required)

Fraunhoffer diffraction at a single slit, double slit- missing orders in double slit, theory of plane diffraction grating-(normal incidence, N slits)- width of principal maxima-absent spectra-overlapping of spectral lines-determination of wavelength of a spectral line-dispersive power of grating-comparison of prism & grating spectra. Comparison between interference and diffraction.

Text Book :*Optics - Subramanayam, Brijlal, M. N Avadhanalu, S.Chand, Revised 24th EditionChapter 17 (Sec. 17.1 – 17.7, 17.10 -17.10.2) and Chapter 18 (18.1 – 18.2.1, 18.4,18.4.2, 18.4.3, 18.7 – 18.7.2, 18. 7.4 – 18.7.8)*

Module II (12 hours)

Polarization (12hrs)

Polarization- introduction to polarization- polarization by reflection- Brewster's law-Malus' Law-polarization by double refraction-calcite crystal-optic axis- principal section-Huygen's explanation of double refraction-phase difference between e ray and o ray- superposition of waves linearly polarized at right angles-types of polarized light – retarders-quarter wave plates- half wave plates – production and detection of elliptically and circularly polarized light- optical activity- Fresnels explanation of optical rotation (analytical treatment not needed)- specific rotation-application- Laurent's half shade polarimeter.

Text Book :*Optics - Subramanayam, Brijlal, M. N Avadhanalu, S.Chand, Revised 24th Edition, Chapter 20*

Module III (20 hours)

Lasers (11hrs)

Absorption and emission of light-Absorption-spontaneous emission and stimulated emission-light amplification by stimulated emission. Einstein's relations-condition forlight amplification –population inversion-pumping –pumping methods –optical pumping – electrical pumping –injection pumping. Active medium-metastable states- pumping schemes (two level, three level and four level)- Characteristics of laser beam- Optical resonator (theory not required) -Threshold condition. Types of lasers-ruby laser, He-Ne laser, semiconductor laser. Applications of lasers-Holography (principle, recording and reconstruction) - materials processing-cutting, drilling and welding.

Text Books:

1. *An introduction to lasers theory and applications- MN Avadhanulu. S. Chand, Chapters 1,2,3& 5.*
2. *Optics - Subramanayam, Brijlal, M. N Avadhanalu, S.Chand, Revised 24thEditio, Chapter 22& 23.*

Fiber Optics and Optical Communication (9hrs)

Optical fiber- Critical angle of propagation-modes of propagation (Ray theory only)-Acceptance angle-Fractional refractive index change- Numerical Aperture- Types of Optical fibers- pulse dispersion - Applications- Fiber optic communication system- Advantages of Optical fibers.

Text Book :*Optics - Subramanayam, Brijlal, M. N Avadhanalu, S.Chand, Revised 24th Edition, Chapter 24*.

Competencies:

- C1.Recognise the different theories proposed in the field of light.
- C2.Examine the electromagnetic nature of light.
- C3.Define wavefront.

- C4.Recognise the attributes which characterizes a wave.
- C5.Give the mathematical representation of a travelling wave.
- C6.Define the optical path and phase difference.
- C7.Understand coherence.
- C8.Discuss the principle behind interference.
- C9.Recall the conditions for brightness and darkness for interference pattern.
- C10. Estimate the intensity distribution of interference analytically.
- C11. Classify Interference based on the different ways of obtaining of coherent sources.
- C12. Discuss interference in Biprism.
- C13. Estimate the lateral displacement of fringes due to introduction of a plate in the path of one of the interfering beam.
- C14. Explain the interference in plane parallel thin film formed in reflected system.
- C15. Distinguish between the different types of interference fringes in thin film.
- C16. Contrast the interference in reflected and transmitted system.
- C17. Describe the interference in air wedge.
- C18. Determine the thickness of spacer in air wedge.
- C19. Recognize the theory behind colours seen in thin film.
- C20. Explain Newton's rings Formation.
- C21. Determine wavelength of light and refractive index of liquid.
- C22. Illustrate principle, construction and working of Michelson interferometer.
- C23. Generalize the applications of Michelson interferometer.
- C24. Classify diffraction.
- C25. State Fresnel assumptions of diffraction.
- C26. Descibe Fresnel half period zones.
- C27. Recognize the theory of rectilinear propagation
- C28. Identify action of zone plate.
- C29. Compare zone plate and convex lens.
- C30. Explain Diffraction pattern due to a straight edge.
- C31. Extend Fraunhoffer diffraction to single slit, double slit and N slits.
- C32. Explain missing orders in double slit

- C33. Determine wavelength of a spectral line
- C34. Compare prism & grating spectra.
- C35. Differentiate interference and diffraction.
- C36. Define polarization.
- C37. State and prove Brewster's law. Apply it in calculation of polarizing angle and refractive index.
- C38. Understand polarization by double refraction.
- C39. Discuss the Huygen's explanation for double refraction.
- C40. Differentiate between o-ray and e-ray.
- C41. Explain the superposition of waves linearly polarized at right angle.
- C42. List the different types of polarized light.
- C43. Classify retardation plates.
- C44. Discuss the production and detection of elliptically and circulary polarised light.

- C45. Understand the theory behind optical rotation and apply the principle in Laurent's half shade polarimeter.
- C46. Use the concepts of A and B coefficients to predict the possibilities of laser emission.
- C47. Understand the significance of Einstein's coefficients.
- C48. Classify various pumping methods and pumping schemes.
- C49. Describe the working of various lasers mentioned in the syllabus and compare their output wavelengths.
- C50. Understand the basics of holography and use basic theory to explain the formation of real and virtual images.
- C51. Use elementary equations to calculate population, equilibrium temperature, output frequency, and optimum cavity length of various lasers.
- C52. Learn any two applications each of lasers in the field of medicine and material processing.
- C53. Explain the basic principles and fundamental concepts of optical fibers using ray theory.
- C54. Calculate numerical aperture, critical angle, acceptance angle, and normalized

frequency using basic equations.

- C55. Classify optical fibers using refractive index profile.
- C56. Outline the schematic used to convey the meaning of optical fiber communication systems.
- C57. Explain how light as a carrier wave will increase the communication band width.

- C58. List the advantages of OFC compared to electrical communication systems.
- C59. Explain the formation of modes using ray theory.

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Semester V Core Course

PH5B07B18 – Physical Optics and Photonics

Module	**Hours** **54**	**Marks** **1**	**Marks** **5**	**Marks** **10**	**Total** **60**
		10/ 12	**6/9**	**2/4**	
I Wave optics Interference Diffraction	22	5	3	2	40
II Polarization	12	2	2	1	22
III Lasers Fiber Optics and Optical Communication	20	5	4	1	35

Semester V

PH5B08B18 - DIGITAL ELECTRONICS AND PROGRAMMING

Credits – 3

Total lecture hours – 54hrs

Aim

This course is expected to nurture basic understanding of principles of digital electronics and to provide necessary back ground to the major aspects of combinational and sequential logics.

Course Overview and context

The course on digital electronics starts from different number system- specifically, the binary number system and the various operations associated with it. Boolean algebra is introduced and discussed in detail. Finally, the course includes topics such as combinational and sequential logics.

Module I

Boolean algebra and logic gates(9 hours)

Basic gates NOT, OR, AND. Universal Logic Gates- NOR, NAND. XOR and XNOR Gates. Rules and Laws of Boolean algebra. Duality theorem -De Morgan's Theorems. analysis and simplification of logic circuits. Boolean equation and truth table - SOP and POS. Minterms and Maxterms. Standard SOP and Standard POS- Conversion between Standard SOP & Standard POS. Karnaugh Map (up to four variables). K map SOP minimization.

Text Book: *Digital principles and applications 5thEdn. Malvino, Leach, TMH. Chapter 2 and 3.*

Module II(19 hours)

Combinational logic (6 hours)

Half Adder and Full Adder, Half and Full subtractor, 4-bit parallel Adder/Subtractor. Multiplexer, De-multiplexer, Encoder & Decoder.

Sequential logic (13 hours)

Flip-flops, RS, Clocked RS, Master Slave JK FF, DFF, T Flip-flop, Buffer registers- Shift register-SISO and SIPO, Counters- Binary ripple counter. D/A converters (Ladder type),

A/D Converter (Counter type).

Text Books:

1. *Digital principles and applications 5th Edn. Malvino, Leach, TMH. Chapter 6 (Sec. 6.7&6.8) and Chapter 4 (Sec. 4.1 - 4.6), Chapter 8(Sec. 8.1-8.7), Chapter 9 (Sec.9.1& 9.2).*
2. *Digital Computer Electronics- Malvino, Appendix 1 The analog interface.*

Module III

Programming in C++ (26 hours)

Basic C++ program structure –comments-data types-variable types-constants operators (arithmetic, relational, logical and assignment operators)- if, if-else and else if, do while - case – loops(while, do-while, and for)-nested loops- arrays(Defining Arrays, Accessing Array Elements, Initializing Arrays)- basic ideas of functions(qualitative idea), object and classes. Programs using loops.

Text Book: *Object oriented programming in turbo C++ -Robert Lafore (galgotia Pub) chapter 2,3 and 7*

References:

1. Digital design- M Morris Mano PHI

2. Digital logic and computer design - M Morris Mano PHI

3. Digital Electronics- William H Gothmann PHI

4. Digital principles and applications 6th Edn. Malvino, Leach and Saha TMH

5. Digital circuits and design- S Salivahanan and S Arivazhakan PHI

6. Digital Electronics- Sedha S Chand

7. Pulse, Digital and switching wave forms –Millam and Taub.

8. Digital computer electronics- Malvino, Brown TMH

9. Digital electronics- Tokheim(TMH)

Competencies:

- Differentiate logic gates.
- Compare operators, logic symbols and truth tables of different logic gates.
- State laws of Boolean algebra.
- Describe Demorgan's and duality theorem.
- Use Sum of product method, product of sum method for reducing Boolean expressions.
- Simplify Boolean functions using Karnauh map.
- Categorize Adder circuits.
- Mention encoders, decoders, multiplexers and demultiplexers.
- Illustrate and classify Flip-flops, Registers and Counters.
- Describe D/A and A/D converters.
- Understand C++ program structure
- Illustrate data types in C++.
- Recognize variables.
- Explain input/output with c_{out} and c_{in}.
- Explain arithmetic operators and library functions.
- Illustrate relational operators.
- Explain for, while and do while loops.
- Explain if, if-else and switch decision statements.
- Explain the conditional operator and recognize its significance.
- Explain logical operators and exit ().
- Explain loop control statements-break, continue and the goto.
- Illustrate structures.
- Explain simple functions.
- Categorize variables and storage classes.
- Explain a simple class.
- Explain C++ objects as physical objects and C++ objects as data types.
- Explain one and two dimensional arrays.

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V Semester Core Course

PH5B08B18 - DIGITAL ELECTRONICS AND ROGRAMMING

Module	**Hours** **54**	**Marks** **1**	**Marks** **5**	**Marks** **10**	**Total** **60**
		10 / 12	**6/9**	**2/4**	
I Boolean Algebra	9	3	1	1	18
II Combinational Logic, Sequential Logic	19	4	4	1	34
III Programming in C++	26	5	4	2	45

Semester VI

PH6B09B18 Thermal and Statistical Physics

Credits – 3

Total lecture hours – 54hrs

Aim

The topics on thermodynamics are intended to develop a basic knowledge required to design any device involving the interchange between heat and work or the conversion of material to produce heat. The topic on statistical mechanics, on the other hand is expected to provide an understanding of the behavior of these systems in a microscopic level.

Course overview and context

Thermodynamics describes the bulk behavior of the body, not the microscopic behavior of the very large numbers of its microscopic constituents, such as molecules. The first module deals with the behavior of real gases, the laws of thermodynamics and the working of heat engines. The concept of entropy, thermodynamic potentials and the various laws of thermal radiation are discussed in the second module. The third module deals with the fundamental topics of statistical mechanics and a description of the different types of statistics.

Module I

Thermal Physics (20hrs)

Behaviour of real gases-Change of state, Continuity of state, Andrew's experiments on Carbon dioxide-Critical constants- Behaviour of gases at high pressure-Boyle temperature-Reasons for modification of gas equation-Vander Waals equation of state-Comparison with experimental PV curves-Estimation of critical constants - Constants of Vander Waals equation-Critical coefficient-Limitations of van der Waals equation.

Thermodynamic system- Zeroth law(Statement and explanation)-Thermodynamic equilibrium- First law of thermodynamics- Applications of first law-Specific heats of a gas, isochoric process, isobaric process, adiabatic process, adiabatic equation of a perfect gas, cyclic process, isothermal process-Indicator diagram- Work done during isothermal and adiabatic process- slopes of adiabatics and isothermals- relation between adiabatic and isothermal elasticities

Reversible and irreversible process- Heat Engines-Carnot's ideal heat engine-Carnot's cycle-Effective way to increase efficiency-Carnot's engine and refrigerator-coefficient of

performance -Second law of thermodynamics-Kelvin's and Clausius's statement-Carnot's theorem-.

Text Book: *Thermodynamics and Statistical physics Brij Lal, N.Subrahmanyam and P S Hemne, S. Chand &Co, Multicolour edition 2007, Chapters 2and 4*

Module II

Thermodynamic relations and Thermal radiation (16hrs)

Entropy- change in entropy- entropy change in adiabatic process and reversible cycles- Principle of increase of entropy- The T-S diagram- Physical significance of entropy- Entropy of steam- Third law of thermodynamics: Nernst's Heat theorem-Zero point energy.

Thermodynamic potentials- Significance of thermodynamic potentials- relation of thermodynamic potentials with their variables- The TdS equations- Clapeyron's Latent heat equation using Maxwell's Thermodynamical relations.

Thermal radiation- Prevost's theory of heat exchanges- Black body- Fery's black body- Black body radiation and its temperature dependence- Emissive power and absorptive power-Stefan –Boltzmann law- .

Text Book: *Thermodynamics and Statistical physics Brij Lal, N.Subrahmanyam and P S Hemne, (S. Chand &Co, Multi colour edition 2007, Chapters 5,6and8.*

Module III

Statistical Mechanics (18hrs)

Probability – Principle of equal a priori probability – Micro and macro state – Thermodynamic probability

Position space, Momentum space, phase space, mu – space and gamma space (qualitative ideas only) Minimum size in classical and quantum mechanics – entropy and thermodynamic probability - Boltzmann's entropy relation – Ensembles – Kinds of ensembles – Gibbs paradox

Three kinds of statistics – Classical statistics – Maxwell – Boltzmann Distribution law – Need of quantum statistics – indistinguishability of particles – Bose – Einstein Distribution law and its application to black body radiation – Fermi – Dirac statistics and its application to

electron gas

Text Book: *Brij Lal, N.Subrahmanyam and P S Hemne, Multi colour edition 2007, Chapters 9,10,11,12*

Reference:

1. *Heat and Thermodynamics, Mark W Zemaskay and Richard H Dittman, TataMcGraw-Hill Publishing Co. (Special Indian Edition)*
2. *Thermodynamics and Statistical Mechanics, Greiner, Springer*
3. *Berkeley Physics Course Volume 5; Statistical Physics; Frederick Reif. McGraw Hill.*
4. *A Treatise on Heat; Saha and Srivastava, The Indian Press, Allahabad.*
5. *Statistical Mechanics, R.K. Pathria, Pergamon press, Oxford*

Competencies

- Explain how a real gas differs from an ideal gas.
- Describe Andrew's experiment on carbon dioxide.
- Differentiate between gas and vapour using Andrew"s experimental isothermals for CO_2.
- Explain Critical constants of a gas.
- Introduce Boyle temperature and explain the behavior of gases above, below and at
- Boyle temperature.
- Derive and discuss Vander Waals equation of state of a gas.
- Understand the concept of Thermodynamic system.
- Explain Zeroth law of thermodynamics.
- Illustrate Thermodynamic equilibrium.
- Explain first law of thermodynamics.
- Apply first law to isochoric process, isobaric process and adiabatic process.
- Derive the equation for adiabatic process of a perfect gas.
- Explain cyclic process.
- Exemplify Indicator diagram.
- Derive the work done during isothermal and adiabatic process.
- Determine slopes of adiabatics and isothermals.

- Relate adiabatic and isothermal elasticities.
- Differentiate between reversible and irreversible process.
- Describe the parts of heat engines.
- Explain Carnot's ideal heat engine using Carnot's cycle and derive its efficiency.
- Describe effective ways to increase efficiency of Carnot's engine.
- Compare the working of a heat engine and refrigerator
- Define coefficient of performance a refrigerator.
- Explain second law of thermodynamics.
- State and verify Carnot's theorem.
- Distinguish between internal and external combustion engines.
- Describe the working of Steam engine, Otto engine, Petrol engine and Diesel engine and derive their efficiencies.
- Understand the concept of entropy and change in entropy.
- Derive entropy change in adiabatic process and reversible cycles.
- Explain the Principle of increase of entropy.
- Explain T-S diagram.
- Understand the physical significance of entropy.
- Determine entropy of steam.
- State Third law of thermodynamics: Nernst's Heat theorem.
- Understand the concept of zero point energy.
- Recognize the significance of thermodynamic potentials.
- Establish the relation of thermodynamic potentials with their variables.
- Discuss TdS equations.
- Derive Clapeyron's Latent heat equation using Maxwell's Thermo- dynamical relations.
- Define thermal radiation.
- Describe Prevost's theory of heat exchanges.
- Illustrate black body.
- Understand the temperature dependence of black body radiation.
- Define emissive power and absorptive power.
- State the principle of Equal a priori probability.

- Define and distinguish between micro and macrostates.
- Classify the different coordinate and spaces.
- Derive the Boltzmann's thermodynamic relation.
- Define an ensemble and classify them.
- State and explain Gibb's paradox.
- Explain the three kinds of particles.
- Derive the Maxwell – Boltzmann Distribution Law.
- Discuss the need for quantum statistics and derive Bose – Einstein and Fermi – Dirac distribution laws.
- Discuss one application of B- E and F- D statistics.

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VI Semester Core Course

PH6B09B18- THERMAL AND STATISTICAL PHYSICS

Module	**Hours** **54**	**Marks** **1**	**Marks** **5**	**Marks** **10**	**Total** **60**
		10/ 12	**6/9**	**2/4**	
I Thermal Physics	20	5	2	2	35
II Thermodynamic relations and Thermal radiation	16	5	3	1	30
III Statistical Mechanics	18	2	4	1	32

Semester VI

PH6B10B18- Relativity and Spectroscopy

Credits -3

Total Lecture hours- 72

Aim

To introduce the principles and features of Special theory of Relativity and Spectroscopy. The course is meant to enable the student to understand the laws of physics in the context of relativistic speed and to know how the spectral lines from various atoms and molecules are originated.

Course overview and Context

The first module discusses the changes in mass, energy and time due to relativistic motion. Second module deals with the origin of atomic spectra and advances to describe Nuclear Magnetic Resonance and Electron Spin Resonance. Third module gives description of electronic, vibrational and rotational spectroscopy. It also describes Raman scattering, fluorescence and phosphorescence.

Module I

Special Theory of Relativity (18 hrs)

Inertial and non inertial frames of reference- Galilean transformation, Significance of Michelson-Morley experiment, Postulates of Special Theory of Relativity, Lorentz transformation, Spatial contraction, Time dilation, composition of velocities, mass of moving particle, Equivalence of mass and energy.

Text Books:

1. *Modern Physics, G. Aruldhas, P. Rajagopal, PHI Learning Pvt. Ltd. Chapter 1*
2. *Concepts of modern Physics, Arthur Beiser*

Module II

Atomic Spectroscopy (22 hours)

Types of spectra. Absorption and emission of light by atoms, quantum theory, early atom

models – Bohr model, Vector Atom model, Quantum numbers associated with vector atom model, Coupling Schemes- L-S coupling, j-j coupling, Pauli Exclusion principle, Magnetic dipole moment due to orbital and spin motion of electron, Spin-Orbit coupling.

Optical spectra, spectral terms and notations, selection rules, intensity rule and interval rule, fine structure of sodium D line, Zeeman Effect, Larmors theorem, quantum mechanical explanation of the normal Zeeman Effect, Anomalous Zeeman effect, Paschen Back Effect and Stark Effect

Text Books:

1. *Modern Physics, R Murugeshan & KiruthigaSivaprasath , S Chand, Chapter 6 (Relevant sections)*
2. *Concepts of modern Physics, Arthur Beiser*
3. *Modern Physics, G Aruldhas & P Rajagopal, PHI Learning Pvt. Ltd.*

Module III

Molecular spectroscopy (22 hours)

Electromagnetic spectrum, Molecular energies, Classification of molecules, Rotational Spectra of diatomic molecules, Diatomic vibrational spectra, Explanation with simple harmonic oscillator.

Electronic Spectra of molecules, Phosphorescence and Fluorescence, Raman Scattering, Classical description of Raman scattering and its failure, Quantum theory of Raman Scattering, Raman Spectrometer.IR and Microwave spectroscopes.

Text books:

1. *Fundamentals of molecular spectroscopy, Colin N. Banwell and Elanine M McCash,Tata McGraw- Hill -*
2. *Modern Physics,GAruldhas& P Rajagopal - PHI Learning Pvt. Ltd,*
3. *Concepts of Modern Physics, Arthur Beiser, McGraw Hill Education (India) Pvt. Ltd.*

NMR and ESR Spectroscopy (10hours)

NMR Spectroscopy- Basic principles and instrumentation- Medical applications of NMR.

Text Book: *Molecular structure and Spectroscopy, G Aruldas – Chapter 10 (Sections10.1, 10.2,10.3 and 10.19).*

ESR Spectroscopy- Basic principles and instrumentation.

Text Book: *Molecular structure and Spectroscopy, G Aruldas – Chapter 11 (Sections 11.1, 11.2 and 11.3).*

References:

1. *Concepts of modern Physics, Arthur Beiser, Tata McGraw Hill Publication*
2. *Modern Physics, Kenneth S Krane.*
3. *Mechanics, H S Hans, S P Puri, Tata McGraw Hill Education Pvt. Ltd.*
4. *Classical Mechanics – K. Sankara Rao, Prentice Hall of India*
5. *Fundamentals of molecular spectroscopy, Colin N. Banwell and Elanine M McCash, Tata McGraw- Hill*
6. *Modern Physics ,G Aruldhas& P Rajagopal Sections - PHI Learning*
7. *Modern Physics, R Murugeshan & KiruthigaSivaprasath , S Chand*
8. *Molecular structure and Spectroscopy, G Aruldhas, Prentice Hall of India*

Competencies:

- Recognize the relative nature of motion.
- Categorize frames of reference.
- Illustrate Galilean transformation.
- Describe Michelson Morley experiment.
- Recognize the significance of Michelson Morley experiment
- State the postulates of Special Theory of Relativity.
- Explain Lorentz transformation and velocity transformations.
- Extend the Lorentz transformation to concepts of Length contraction, time dilation and relativistic Mass.
- Summarize the equivalence of mass and energy.
- Outline the introductory concepts of general theory of relativity.

- Describe absorption and emission spectrum of light by atoms.
- Give quantum theory regarding emission or absorption of light.
- Explain early atom models.
- Elaborate on Bohr atom model
- Apply Bohr modelto find energy and radius of electronic states.
- Describe Vector Atom model
- Illustrate the quantum numbers associated with Vector atom model
- Compare the Coupling Schemes- L-S coupling, j-j coupling
- State Pauli Exclusion principle
- Find the Magnetic dipole moment due to orbital and spin motion of electron
- Discuss the Stern and Gerlach Experiment to establish electron spin
- Outline the effect of Spin-Orbit coupling.
- Describe the spectral terms and notations
- State selection rules for emission of spectral lines.
- Give the intensity rule and interval rule for spectral lines
- Illustrate the fine structure of sodium D line
- Discuss Zeeman Effect
- State Larmors theorem
- Give the quantum mechanical explanation of the normal Zeeman Effect,
- Explain with theory the Anomalous Zeeman effect
- Distinguish between Paschen Back Effect and Stark Effect
- Examine the components of electromagnetic spectrum
- Describe the Molecular energies -electronic, vibrational and rotational
- State the classification of molecules
- Examine the Rotational Spectra of diatomic molecules
- Illustrate the Diatomic vibrational spectra of molecules
- Explain the vibration spectra of molecule in comparison with simple harmonic oscillator.
- Differentiate between Phosphorescence and Fluorescence
- Examine Raman Scattering

- Illustrate Quantum theory of Raman Scattering
- Justify Raman scattering with the classical description.
- Describe Raman Spectrometer
- Describe IR spectroscope
- Describe Microwave spectroscope.
- Write down the principle of Nuclear magnetic Resonance (NMR)
- Describe the instrumentation techniques for NMR spectroscopy.
- Give the medical applications of NMR spectroscopy.
- Write down the Principle of Electron spin resonance (ESR)
- Describe the instrumentation techniques for ESR spectroscopy.

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Semester VI Core course

PH6B10B18- Relativity and Spectroscopy

Module	**Hours** **72**	**Marks** **1** **10/ 12**	**Marks** **5** **6 / 9**	**Marks** **10** **2/4**	**Total** **60**
I Special Theory of Relativity	18	4	3	1	29
II Atomic Spectroscopy	22	4	3	1	29
III Molecular and NMR and ESR Spectroscopy	32	4	3	2	39

Semester VI

PH6B11B18 – NUCLEAR, PARTICLE AND ASTROPHYSICS

Credits – 3

Total lecture hours – 54hrs

Aim

This course is intended to explore the interior of nucleus and to understand the paramount importance of nucleus in the grant scheme of things.It is also aimed to provide an exposure to Particle Physics, a branch of physics that studies the elementary constituents of matter and the interactions between them. Further this course gives an outline of Astrophysics.

Course Overview and context

Nuclear physics is a science dealing with structures, elements and forces of the nuclei. And its applications in modern world are enormous ranging from production of nuclear energy, weapons to diagnosis and treatment in medicine. The course starts with the basic topics such as classification and static properties of nuclei, nuclear forces. Then it gives an introductory note on models and detectors of nuclear radiations. The principal aspects of radioactivity, nuclear reactions, particle physics are further included in this course. Basic aspects of Astrophysics is also included.

Module I

Nuclear structure & General properties of nuclei (15 hrs)

Classification of nuclei – isotopes, isobars, isomers, mirror nuclei. General properties of nucleus – size, nuclear mass, density, charge - angular momentum- nuclear magnetic dipole moments- electric quadrupole moment- Mass defect- binding energy- B.E. curve- packing fraction- nuclear stability. Theories of nuclear composition – proton-electron hypothesis, proton-neutron hypothesis. Properties of Nuclear forces – Meson theory of nuclear forces. Models of Nuclear structure- Liquid drop model -semi empirical mass formula- shell model- collective model (Quantitative ideas only). Detectors of nuclear radiations – ionisation chamber, Proportional counter, G.M Counter.

Text Book:*Modern Physics R. Murugeshan Kiruthiga Sivaprasad, S. Chand. Thirteenth Revised Multicolour Edition 2007, Chapter 27 Section 27.1- 27.12 , & Chapter 29 Sections*

29.3,29.5,29.6

Module II(20 hours)

Radioactivity (14 hrs)

Natural radioactivity – Radioactive disintegration law – half life, Mean life- Radioactive series. Radioactive dating – Uranium dating, Carbon dating. Range of α particles – range – energy relationship. Geiger – Nuttal law - Alpha particle disintegration energy- Theory of α decay – Gamow's theory. β decay - β ray energy spectrum- Neutrino hypothesis- Positron emission, orbital electron capture (Basic ideas only). γ decay – Internal conversion - Electron positron pair production by γ rays-Electron positron annihilation. Artificial radioactivity- Transuranic elements. (Basic ideas only). Nuclear waste disposal - radiation hazards from nuclear explosion.

Text Book: *Modern Physics- R. Murugeshan Kiruthiga Sivaprasad S.Chand. Thirteenth Revised Multicolour Edition 2007, Chapter 31,For topics Nuclear waste disposal and radiation hazards from nuclear explosion, Chapter 32,For topics Artificial radioactivity Chapter 34 Section 34.9,For topics Transuranic elements Chapter 35, Section 35.10*

Astrophysics (6 hours)

Classification of stars – Hertzsprung - Russel diagram – Luminosity of a star – Stellar evolution - White Dwarfs - Chandrasekhar limit - Neutron stars - Black holes – Supernova explosion.

Text Book: *Modern Physics, R Murugeshan and K. Sivaprasath, 15th Edition (Revised) (2010), S. Chand, Chapter 31.*

Module III(19 hours)

Nuclear fission & Fusion (9 hrs)

Discovery of nuclear fission – Energy released in fission - Bohr and Wheeler Theory- chain reaction- Atom Bomb-Nuclear reactors –Power reactors, Breeder reactor. Nuclear fusion – Sources of stellar energy – Proton-Proton cycle, Carbon - Nitrogen cycle- Thermonuclear reactions - Hydrogen bomb- Controlled thermonuclear reactions.

Text Book:*Modern Physics- R. Murugeshan Kiruthiga Sivaprasad S.Chand. Thirteenth*

Revised Multicolour Edition 2007, Chapter 35Section 35.1- 35.9

Elementary particles (10 hrs)

Particles and antiparticles –Antimatter- Fundamental interactions in nature. Classification of elementary particles (based on nuclear interactions)-Resonance particles-Higgs bosons Elementary particle quantum numbers- conservation laws- symmetry, the quark model – Compositions of hadron (based on quark model). Cosmic rays – Discovery - lattitude effect- altitude effect- east west effect- Primary and secondary ray –Cosmic Ray showers-Origin of cosmic rays.

Text Book:*Modern Physics- R. Murugeshan Kiruthiga Sivaprasad, S.Chand. Thirteenth Revised Multicolour Edition 2007, Chapter 38, Sections 38.1- 38.7 and Chapter 37, Sections 37.1- 37.7&37.10-37.11*

References:

1. *Modern Physics- Aruldhas & P.Rajagopal, PHI*
2. *Concepts of Modern Physics -Arthur Beisser*
3. *Atomic and Nuclear Physics (Ch. 15) R. Murugeshan S.Chand*
4. *Nuclear Physics D. C. Tayal*
5. *Nuclear and Particle Physics S L Kakani and Subhra Kakani -Viva Books 2008*
6. *Elements of Nuclear Physics, M L Pandya and R P S Yadav, Kedar Nath Ram Nath*
7. *Modern Physics, Kennth Krane, 2nd Edition, Wiley India (Pvt) Ltd.*
8. *Modern Physics , G. Aruldhas and P. Rajagopal, Prentice-Hall India*
9. *An Introduction to Astrophysics, Baidyanath Basu, 2nd Edition, Prentice-Hall India*

Competencies:

- Identify Isotopes, Isobars, Isomers, Mirror nuclei.
- Illustrate General properties of nucleus
- Describe angular momentum, nuclear magnetic dipole moments and electric quadrupole moment.
- State Mass defect, binding energy
- Draw and explain B.E. curve.

- Explain the theories of nuclear composition
- Recognize properties of Nuclear forces
- Classify Models of Nuclear structure
- Distinguish and differentiate detectors of nuclear radiations.
- State Radioactive disintegration law
- Illustrate half life, Mean life
- Retrieve Radioactive series, radioactive dating.
- Explain Range of α particles, range – energy relationship.
- State Gamow's theory of α decay.
- Understand β & γ decay and associated processes
- Mention artificial radioactivity, transuranic elements
- Recognize nuclear waste disposal & radiation hazards from nuclear explosion
- Illustrate Energy released in fission
- State Bohr and Wheeler Theory
- Classify Nuclear reactors
- Associate & discuss Sources of stellar energy
- Categorize Fundamental interactions in nature
- Classify elementary particles
- Instantiate the quark model.
- Distinguish primary & secondary cosmic rays
- Discuss latitude effect, altitude effect, east west effect.

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VI Semester Core Course

PH6B11B18 NUCLEAR, PARTICLE AND ASTROPHYSICS

Module	**Hours**	**Marks 1**	**Marks 5**	**Marks 10**	**Total 60**
		10 / 12	**6/9**	**2/4**	
I Nuclear structure & General properties of nuclei	15	3	3	1	28
II Radioactivity Astrophysics	20 (14+6)	4	2	2	34
III Nuclear fission & Fusion Elementary particles	19 (9+10)	5	4	1	35

Semester VI

PH6B12B18 - CONDENSED MATTER PHYSICS

Credits – 3

No. of contact hours – 72

Aim

This course aims to provide a comprehensive introduction to the subject of Condensed Matter. It intends to provide with a basic foundation in the subject and also to familiarize the student with new and advanced topics in the field.

Course Overview and Context

Condensed matter physics deals with the physical properties of condensed phases of matter which try to understand their behavior by using physical laws. In particular, these include the laws of quantum mechanics, electromagnetism and statistical mechanics. This course provides basic knowledge about the structure of crystals, theories that discuss the distribution and motion of electrons in materials and the properties thereof. It also explores new materials like superconductors, polymers, nanomaterials, liquid crystals which have high prospects of application.

Module I (19 hours)

Crystal Structure (14 hrs)

Crystal lattice – Unit cell- Basis – Symmetry Operations – Point groups and Space groups – Types of lattices – Lattice directions and Planes – Miller Indices - Interplanar spacing – Crystal structures – simple cubic, fcc, bcc and hcp – structure of diamond, Zinc Blende and sodium chloride

X Ray Diffraction (5 hrs)

Bragg's Law – Experimental methods of X ray Diffraction –Laue's Method – Rotating crystal method - Powder Method – Reciprocal Lattice – Reciprocal lattice vectors – Elementary ideas only

Text Book : *Solid State Physics – R. K. Puri and V. K. Babbar, Chapter 1 and 2*

Module II(31 hours)

Free Electron Theory and Band theory of Solids (12 hrs)

Drude – Lorentz's classical theory – Sommerfeld's quantum theory – Free electron gas in one dimension – Fermi energy – Total energy- Density of states – Filling of energy levels – Application of free electron gas model

Band theory – Bloch theorem (statement only) – Kronig – Penney model (Qualitative ideas only) – Velocity and effective mass of electron – Distinction between metals, insulators and semiconductors.

Semiconducting Properties of materials (10 hrs)

Semiconductors – Intrinsic and Extrinsic – Drift velocity – mobility and conductivity of Intrinsic semiconductors - Carrier concentration, Fermi level and conductivity for intrinsic and extrinsic semiconductors (Expression only), Hall Effect

Text Book : *Solid State Physics – R. K. Puri and V. K. Babbar - Chapter 5, 6 and 7*

Materials Science and Technology (9 hrs)

Amorphous Semiconductors – Band structure- Optical absorption - Liquid Crystals – Nematic phase – Cholestric phase – Smectic Phase - Polymers – Effect of temperature - Thin films – Electron beam deposition technique –Chemical vapour deposition

Text Book :

1. *Elementary Solid State Physics - Ali Omar (Pearson) -Chapter 12*
2. *Thin film fundamentals - A. Goswami, New Age International,2008 -Chapter1*

Module III(22hours)

Magnetic and Dielectric properties of Solids (12 hrs)

Types of Magnetism – Langevin's classical theory of Dia and Paramagenetism – Ferromagnetism –Weiss theory - Domains and hysteresis – Antiferromagnetism and ferrimagnetism (Qualitative ideas only)

Dielectric properties – Local field – dielectric constant and polarisability – Clausius Mossotti relation – Sources of polarisability – Frequency dependence – Ferro and Piezo electricity (Qualitative ideas only)

Text Book : *Solid State Physics – R. K. Puri and V. K. Babbar Chapter 8 and 9*

Superconductivity (10 hrs)

Superconducting phenomenon – Meissner effect –Critical field – Penetration depth - Type I and Type II superconductors – Entropy, specific heat, energy gap – Isotope Effect – London equations - Josephson Effect and Tunneling – SQUIDs – BCS theory (qualitative ideas only) – Cooper Pairs – High temperature Superconductors - Applications

Text Books :*Solid State Physics – R. K. Puri and V. K. Babbar - Chapter 10*

References

1. *Introduction to Solid State Physics- Kittel, C. Wiley -8th edition*
2. *Elementary Solid State Physics - Ali Omar - Pearson*
3. *Solid State Physics, P.K. Palanisamy, Scitech publications*
4. *Solid State Physics -Ashcroft, N.W. &Mermin, N.D., TMH*
5. *Solid State Physics - Blakemore, J.S., Cambridge, 2nd edition*
6. *Solid State Physics - C.L. Arora,. S Chand.*
7. *Solid State Physics - S.O. Pillai,. New Age International*
8. *Superconductivity, Superfluids and Condensate - James F Annett - Oxford*

Competencies

- Define the fundamental terms needed to study the structure of a crystal.
- Describe the symmetry operations in a crystal.
- Define point groups and space groups.
- Discuss the different types of lattices.
- Use the idea of Miller indices to represent lattice directions
- Distinguish the different crystal structures with examples.
- State and prove Bragg's law.
- Discuss the experimental methods of X- ray diffraction
- Compare the three experimental method of X- ray diffraction
- Explain the concepts of reciprocal lattice and reciprocal lattice vectors.
- Discuss the classical and quantum theories of free electron model.

- Derive expressions for Fermi energy, total energy and density of states for a free electron gas in one dimension.
- Describe the filling of energy levels in a metal.
- Discuss one application of free electron gas model.
- State Bloch's theorem.
- Discuss band theory qualitatively using Kronig – Penney model.
- Derive expressions for velocity and effective mass of an electron using the ideas of band theory.
- Classify materials on the basis of their band structure.
- Define semiconductors and classify them.
- Discuss the ideas of carrier concentration, Fermi level and conductivity for semiconductors study the expressions.
- Explain Hall effect and derive expression for Hall coefficient.
- Describe the properties of amorphous semiconductors
- Discuss the band structure of amorphous semiconductors
- Explain the properties of liquid crystals
- Classify liquid crystals based on structures.
- Discuss about polymers and the effect of temperature on them.
- Discuss fundamental ideas and properties of thin films.
- Discuss the different deposition techniques of thin films
- Classify magnetic materials and discuss their properties.
- Discuss Langevin's classical theory for dia and paramagnetic materials.
- Discuss Weiss theory of feromagnetism
- Explain domains and hysteresis for ferromagnetic materials.
- Define antiferromagnetic and ferromagnetic materials.
- Explain the dielectric properties of materials.
- Define local electric field and derive Clausius – Mosotti relation.
- Distinguish between different types of polarisabilities and discuss their frequency dependence.
- Explain ferro and piezo electricity.
- Explain the phenomenon of superconductivity.

- Discuss the fundamental properties of superconductors.
- Classify superconductors into Type I and Type II and discuss about them.
- Define Josephson effect and discuss how it is used in SQUIDs.
- Explain BCS theory of superconductivity qualitatively.
- Derive London equations and study their significance
- Mention of different high Tc materials and their features
- Discuss the applications of superconductors.

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VI Semester Core Course

PH6B12B18 - Condensed Matter Physics

Module	**Hours** **72**	**Marks** **1** **10 / 12**	**Marks** **5** **6/9**	**Marks** **10** **2/4**	**Total** **60**
I Crystal structure Xray diffraction	19	5	2	1	25
II Free electron & band theory Semiconducting properties Material Science	31	2	4	2	42
III Magnetic & dielectric properties Superconductivity	22	5	3	1	30

CHOICE BASED COURSES

Semester VI

PH6B13aB18-NANOSCIENCE AND NANOTECHNOLOGY

(Choice Based Course)

Credits - 3

Total lecture hours - 54 hrs

Aim

Nanoscience is the best example of a truly interdisciplinary research field where contributions from Physics, Chemistry, Engineering, Mathematics and Biotechnology design the developmental pattern of relatively new branch of science. This in turn nurture many other high tech ventures like optics, photonics, medicine, computers, automobiles, besides providing luxuries like self cleaning windows, smart surfaces, cosmetics and so on. In fact there is nearly nothing that nanoscience has not influenced. To enable them understand the science of small things, synthesis and analysis techniques and then to probe much more, Nanoscience and Nanotechnology is the right beginning.

Course Overview

The course summarises the fundamentals and technical approaches in synthesis, fabrication and processing of nanostructures and nanomaterials so as to provide a systematic and coherent picture of the field. Also some important nanostructures and nanodevices are introduced.

Module I(18 hours)

Introduction to Nanoscience (5 hrs)

Introduction to nanoscience- Bulk to nano transition- magic numbers-formation of 13 atom nanoparticles- mass spectroscopy, Size Dependence of Properties- mechanical, optical, electrical and magnetic properties at the nanoscale.

Text Books:

1. *Nanoscope – Santhi A, MedTech (Scientific International), Chapter*

2. *Introduction to Nanotechnology, C P Poole, Wiley Interscience, Chapter 4*

Applications of Nanotechnology (2 hrs)

Nanomedicines, smart surfaces-smart window, self cleaning surfaces, smart paint, applications in automobile. MEMS,NEMS.

Text Books:

1. *Nanophotonics, Paras N Prasad, Wiley Interscience, Chapter 14*
2. *Introduction to nanotechnology, C P Poole, Wiley Interscience, Chapter*

Quantum Confined Structures (11 hrs)

Quantum confined structures-Quantum Wells, Wires, and Dots - Fermi gas model - Comparison of density of states and energy dispersion curve in bulk, Quantum well, Quantum wire and Quantum dots. Equation representing energy of electrons and holes in the quantum confined structures and the concept of Blue shift in band gap - properties dependent on density of states - absorption, emission. Applications – quantum confined structures as lasing media.

Text Books:

1. *Introduction to nanotechnology, C P Poole, Wiley Interscience, Chapter 9*
2. *Nanophotonics, Paras N Prasad, Wiley Interscience, Chapter 4*

Module II(16 hours)

Synthesis techniques (10 hrs)

Overview of Top down and Bottom Up methods. Top - down methods: a) ball milling b) laser ablation c) arc discharge method d)Lithography - electron beam lithography, nanoimprint lithography, two photon lithography. Bottom - up methods: a) homogenous nucleation, b) sol gel method, c)MBE, d) chemical vapour deposition, e) pulsed laser deposition.

Text Books:

1. *Nanotechnology –The Science of Small- M. A Shah,K A Shah Wiley ,Chapter 4*
2. *Introduction to nanotechnology, C P Poole, Wiley Interscience, Chapter 4, 9*
3. *Ball milling basic ideas from Preparation of Lithium Niobate Nanoparticles by High Energy Ball Milling and their Characterization, SujanKar et al., Universal Journal of Materials Science 1(2): 18-24, 2013*
4. *Introduction to Nanoscience and Nanotechnology, K.K. Chattopadhyay and A. N Banerjee, PHI Learning and Pvt. Ltd Chapter 6*

Methods of Characterization (6 hrs)

XRD- Determination of crystallographic structure- Particle Size Determination, Surface Structures, Microscopy for structure and size determination-Transmission Electron Microscopy- Scanning Electron Microscopy, AFM, STM

Text Books:

1. *Nanoscope – Santhi A, MedTech (Scientific International), Chapter*
2. *Introduction to nanotechnology, C P Poole, Wiley Interscience, Chapter 3*

Module III(20 hours)

Carbon nanostructures (8 hrs)

Carbon nanostructures: Carbon molecules, Buckminister fullerene, Carbon nanotube-structure, Properties-Electrical properties, Vibrational Properties, Mechanical Properties. Applications of Carbon Nanotubes –Computers, Fuel Cells, Chemical Sensors, Catalysis, Mechanical Reinforcement, Field Emission and Shielding. (Elementary ideas).

Text books*:*

1. *Introduction to Nanotechnology, Charles. P. Poole , Jr. and Frank J Owens, Wiley, 2003 Chapter 5.*
2. *Nanostructures and Nanomaterials- Synthesis, Properties & Applications, Guozhong Cao, Imperial College Press, Chapter 6.*

Bulk Nanostructured Materials (12hrs)

Solid Disordered Nanostructures -Failure Mechanisms of Conventional Grain-Sized Materials, Mechanical Properties, Electrical Properties, Optical properties-Porous Silicon - Metal Nanocluster Composite Glasses. Magnetic Properties- GMR, CMR materials, Spintronics, Spin Valve transistors.

Ordered Nanostructures-Natural Crystals-Zeolites-Photonic crystals:1D, 2D, 3D photonic crystals, comparison of photonic and electronic crystals(elementary ideas), features-presence of band gap- reflection and transmission of electromagnetic waves, defect and defect modes-point defect, line defect and surface defect.

Text Books:

1. *Introduction to Nanotechnology, Charles. P. Poole , Jr. and Frank J Owens, Wiley, 2003*
2. *Nanophotonics, Paras N Prasad, Wiley Interscience, Chapter 9*
3. *Photonic crystals , Moulding the flow of light – John D Joannopoulos, Princeton University Press.*

References :

1. *Nanoscience- The Science of the Small in Physics, Engineering, Chemistry, Biology and Medicine, Hans Eckhardt Schaefer, Springer.*
2. *Introduction to Nanoscience and Nanotechnology , Chris Binns, Wiley.*
3. *Introduction to Nanoscience and Nanotechnology, K. K. Chattopadhyay and A. N Banerjee, PHI Learning and Pvt. Ltd*

Competencies:

- Mention the transition from bulk to nanometer dimension.
- Understand magic numbers involved in the formation of clusters.
- Introduce the mass spectroscopy as tool to analyse the cluster.
- Discuss the effect of nano dimension in physical, chemical, optical, electrical and magnetic properties of the material.
- Express current applications of nanotechnology.
- Explain the role of MEMS and NEMS in revolutionising the industry.

- Classify and distinguish the different quantum confined structures with the bulk counterparts.
- Illustrate dimension and confinement effect on some applications such as Infrared Detectors and Quantum Dot lasers.
- Distinguish Top Down and Bottom Up approach in the synthesis of nanomaterials.
- Recognise and understand the synthesis method required for different nanomaterials.
- Introduce different tools used in characterising nanomaterials.
- Examine the different types of carbon nanostructures.
- Describe the structure and properties of Carbon Nanotube.
- Analyse the different applications of Carbon Nano tube.
- Distinguish between ordered and disordered nanostructured materials.
- Mention the failure mechanisms in conventional materials.
- Analyse the various properties of bulk nanostructured materials.
- Discuss the metal nanocluster composite glass and Porous silicon.
- Examine the formation of ordered nanostructured materials as in zeolites.
- Analyse the characteristics of a Single Electron Transistor.
- Classify different types of Magnetoresistive materials.
- Introduce Spin Valve Transistor.
- Distinguish the properties of Photonic and Electronic Crystals.
- Introduce the Photonic Crystal Fibre.
- Identify the defect modes in the PC.
- Explain and illustrate every concept mentioned in the syllabus.

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VI Semester Choice based Course

PH6B13aB18-Nanoscienceand Nanotechnology

Module	**Hours**	**Marks 2**	**Marks 5**	**Marks 15**	**Total 80**
		10 / 12	**6/9**	**2/4**	
I Introduction to Nanoscience Applications of Nanotechnology	18	6	3	1	42
II Synthesis techniques Methods of Characterization	16	4	3	1	38
III Carbon nanostructures,Bulk Nanostructured Materials	20	2	3	2	49

ST. TERESA'S COLLEGE (AUTONOMOUS),
ERNAKULAM CBCSS B.Sc. PHYSICS PROGRAMME -
SEMESTER VI PH6B13aB18– NANOSCIENCE AND
NANOTECHNOLOGY MODEL QUESTION PAPER

Time: 3 Hrs **Max. Marks: 80**

Part A (Answer any **Ten**, each carries **2 marks**)

1. Explain size dependence on magnetic and electric properties.
2. Explain the use of mass spectroscopy in determining magic numbers.
3. Explain the action of self cleaning surfaces.
4. What is quantum confinement?
5. Draw the schematic diagram of a practical quantum well structure and its density of state function.
6. Differentiate between VCSEL and VCEEL.
7. Explain one example each for top down and bottom up fabrication techniques for nanomaterials.
8. Outline reverse micellar synthesis route and its significance?
9. Explain the action of positive and negative resists in electron lithography.
10. Compare the advantages and disadvantages of SEM over TEM.
11. What is an allotrope? Give the allotropes of Carbon.
12. Classify photonic crystals in terms of their dimensionality.

(2 x 10 = 20marks)

Part B (Answer any **Six questions**, each carries **5 marks**)

13. Explain blue shift in band gap taking the example of a quantum dot.
14. Calculate the percentage of surface atoms in the first four (other than magic number = 1) nanoparticles (in terms of size) of an FCC structure.
15. Outline the impact of nanoscience on our life taking its advantages and harmful effects.
16. Using schematic diagrams explain MBE and CVD.
17. Explain two photon lithography and compare its merits over single beam photo lithography.

18. Explain how STM and AFM are used for synthesis and characterization of nanostructures.
19. Explain the electrical properties of carbon nanotube.
20. Discuss and explain any three applications of carbon nanotube.
21. Outline two features of photonic crystals and how they are utilized in photonic applications.

(6x5=30 marks)

Part C (Answer any **Two questions**, each carries **15 marks**)

22. What is the significance of density of states in nanoscience? Derive the equation for D as a function of E of bulk, Q-well and Q-wire. Compare them graphically.
23. Write an essay on a) sol-gel method b) XRD and c) PLD.
24. Discuss and compare various fabrication techniques for Carbon Nanotube.
25. Explain magnetoresistance effects and spintronics.

(15x2=30 marks)

Semester VI

PH6B13bB18 - MATERIAL SCIENCE

(Choice Based Course)

Credits - 3

Total lecture hours - 54 hrs

Aim and Course Overview

Material Science gives the students an insight into the properties and mechanisms in micro and macrostructures. It also establishes the significance of evolving nature of materials into Novel Engineering materials and Nanomaterials. The students are also introduced into the analytical tools.

Module I (18 hours)

Structure and Properties of Materials Classification of engineering materials-Engineering requirement of materials- Level of structures, Microstructure and Macrostructure, Structure-Property relationships, Physical properties of materials, Mechanical Properties-Stress strain relationship, creep, impact strength- Thermal properties, Thermal cracking- Electrical properties- Dielectric strength and dielectric constant- Chemical and Optical properties- Identification of metals and alloys- Identification tests.

Text Book: Material Science-GBS Narang, Chapter 1 and 9

Module II (18 hours)

Optical Properties of Materials

Absorption processes- Fundamental absorption-Exciton absorption- Free –carrier absorption-Photoconductivity- Photoelectric effect- Photovoltaic effect- Photoluminescence-colour centres-Generation of colourcentres

Text Book: Solid State Physics, M.A. Wahab, Chapter-15

Nanoscience

Materials at nanoscale- Quantum confinement - Size effect on shape- Magic numbers- Different types of nanostructures- Quantum dots- Fullerenes- Graphene- Carbon nanotubes- Structure, properties and applications

Text Books:

1. *Nanotechnology-The science of small, MA Shah and KA Shah, Chapter 1 and 2*
2. *Nanoscience and Nanotechnology- Fundamentals to frontiers- MS Ramachandra Rao and Shubra Singh, Chaper 5.*

Modern Engineering Materials

Display devices- active and passive-Liquid crystals- Types of Liquid crystals- Nematic liquid crystals-Cholesteric liquid crystals- Smectic liquid crystals-General features of liquid crystals- Numeric display using LCD- Metallic glasses - Thermodynamic, Mechanical, Electronic and magnetic properties- Applications Shape memory alloy-structural change-general characteristic-Thermomechanical behavior

Text Book: *Semiconductor Physics and Optoelectronics, V.Rajendran et al. Unit-II*

Module III (18 hours)

Nanoscience

Metal nanoclusters-magic numbers, theoretical modelling, geometric and electronic structure, magnetic clusters; Semiconducting nanoparticles- Rare gas and molecular clusters- carbon nanostructures- Carbon clusters, CNT preparation, properties and applications; Quantum wells, wires and dots – preparation, Size and dimensionality effects, applications .

Text Book: *Modern Physics by Murugeshan*

Material Characterization Techniques

Qualitative study of Powder XRD, SEM, TEM, STM, AFM and Raman spectroscopy.

Text Book: *Nanotechnology-The science of small- MA Shah and KA Shah, Chapter 5*

References:

1. *Material Science-GBS Narang, Khanna Publishers*
2. *Solid State Physics (2nd ed.), M.A. Wahab, Narosa pub.*
3. *Nanotechnology-The science of small, MA Shah and KA Shah, Wiley.*
4. *Nanoscience and Nanotechnology- Fundamentals to frontiers- MS Ramachandrarao and Shubra Singh, Wiley.*
5. *Semiconductor Physics and Optoelectronics, V.Rajendran et al., Vikas Publishing House.*

Semester VI

PH6B13cB18-COMPUTATIONAL PHYSICS

(Choice Based Course)

Credits - 3

Total lecture hours - 54 hrs

Aim and Course overview

The course gives the students an overview of solutions of linear and nonlinear equations. The students will be introduced to curve fitting techniques and differentiation and integration.

Algorithms of all methods required

Module I (18 hours)

Solutions of Nonlinear Equations

Bisection Method - Newton Raphson method (two equation solution) – Regula-Falsi Method, Secant method - Fixed point iteration method - Rate of convergence and comparisons of these Methods.

Solution of system of linear algebraic equations

Gauss elimination method with pivoting strategies-Gauss-Jordan method-LU Factorization, Iterative methods (Jacobi method, Gauss-Seidel method)

Module II (18 hours)

Curve fitting: Regression and interpolation

Least squares Regression- fitting a straight line, parabola, polynomial and exponential. Curve Finite difference operators-forward differences, divided difference; shift, average and differential operators- Newton's forward difference interpolation formulae- Lagrange interpolation polynomial- Newton's divided difference interpolation polynomial.

Module III (18 hours)

Numerical Differentiation and Integration

Numerical Differentiation formulae - Maxima and minima of a tabulated function- Newton-Cote general quadrature formula - Trapezoidal, Simpson's 1/3, 3/8 rule –

Solution of ordinary differential equations

Taylor Series Method, Picard's method-Euler's and modified Euler's method –Heun's method-RungeKutta methods for 1st and 2nd order.

Text Books:

1. *Numerical Methods, Balagurusamy, TMH*
2. *Numerical Methods for Scientists and Engineers- K Sankara Rao- PHI*
3. *Introductory Numerical Methods, S SSastry, PHI.*

Semester VI

PH6B13dB18- INSTRUMENTATION

(Choice Based Course)

Credits - 3

Total lecture hours - 54 hrs

Aim and Course overview:

The course familiarizes the students with various measuring systems and their applications. Students will be introduced with different types of transducers, their characteristics and applications.

Module I (10 hours)

Measurements and Measurement Systems

Measurements-Method of measurement-Instruments and measurement systems- Mechanical, Electrical and Electronic instruments-Classification of Instruments- Applications of Measurement Systems - Elements of generalized measurement systems.

Text book:*A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney. A.K- Chapter 1*

Module II (18 hours)

Primary Sensing Elements and Transducers

Mechanical Devices as Primary Detectors – Mechanical Spring Devices – PressureSensitive Primary Devices – Flow Rate Sensing Elements - Transducers-Classification–Characteristics (Static and Dynamic) and Choice of Transducers – Characterization

Text books:

1. *Sensors and Transducers, Patranabis D., Chapter 1*
2. *A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney. A.K- Chapter 25*

Module III (18 hours)

Resistive, Inductive and Capacitive Transducers

Potentiometers –Strain gauges (Theory, types) - Rosettes – Resistance thermometer – Thermistors (materials, Constructions, Characteristics) – Thermocouples-Self inductivetransducer – Mutual inductive transducers – Linear Variable Differential Transformer –LVDT Accelerometer – RVDT – Synchros – Capacitive transducer – Variable Area Type– Variable Air Gap type – Variable Permittivity type – Capacitor microphone.

Miscellaneous Transducers (8 hours)

Light transducers (photo-conductive, photo emissive, photo-voltaic, semiconductor, LDR)– Piezoelectric transducer – Hall Effect transducers – Digital Encoding transducers

Text book: *A Course in Electrical and Electronics Measurements and Instrumentation,Sawhney. A.K- Chapter 1 and 25*

Text books:

1. *A Course in Electrical and Electronics Measurements and Instrumentation,Sawhney A.K, 18th Edition, DhanpatRai& Company Private Limited, 2007.*
2. *Sensors and Transducers, Patranabis D., 2nd edition, PHI, 2015.*

References:

1. *Measurement Systems-Applications and Design, Doebelin. E.A, Tata McGraw Hill*
2. *Principles of Measurement Systems John. P, Bentley,, III Edition, Pearson*
3. *Transducers and Instrumentation, Murthy.D.V.S,, Prentice Hall of India*
4. *Instrumentation- Devices and Systems, Rangan, Sarma, and Mani, Tata-McGrawHill*
5. *Electronic Instrumentation by H.S Kalsi, McGrawHill*
6. *Instrumentation measurements and analysis, Nakra&Choudhary, Tata-McGrawHill*
7. *Mechanical and industrial measurement by R.K. Jain, Khanna Publishers, NewDelhi*

Semester VI

PH6B13eB18-ASTRONOMY AND ASTROPHYSICS

(Choice Based Course)

Credits - 3

Total lecture hours - 54 hrs

Aim and Course overview

The course gives an overview of the techniques and tools in the Observational astronomy. The students are introduced to the large scale structure of universe and its components. It also envisages a glimpse of Astrophysics and evolution of universe.

Module I

Observational astronomy (12 Hours)

Astronomical distance scales – AU, Parsec and light year. Stellar Parallax and distanceto stars from parallax. Magnitude scale - Apparent and absolute magnitudes. Variablestars as distance indicators. Cepheid variables. Astronomy in different bands ofelectromagnetic radiation-Optical, radio and X-ray astronomies, Radiation Laws.

Optical Telescopes. Types of telescopes-refracting and reflecting – Newtonian andCassegrain telescopes. Magnification and f number. Resolving Power, Telescopemounts – alt-azimuth and equatorial mounts.

Text Books :

1. *Astrophysics: Stars and GalaxiesK D Abhyankar Section 3.1 & 4.3,*
2. *Introduction to Astronomy and Cosmology, Ian Morison, John Wiley & Sons, Inc. Chapter 5*
3. *ASTRONOMY, A Self-Teaching Guide, Dinah L. Moché, John Wiley &Sons, Inc. Chapter 2 & 3.*

Module II

Celestial sphere (8 Hours)

Concept of celestial sphere - cardinal points, celestial equator, ecliptic, equinoxes.Diurnal motion of sun - summer solstice and winter solstice. Celestial co-ordinatesystems: – Horizon system – Azimuth & Altitude, Equatorial system-Right ascension &declination, Ecliptic coordinate system.

Time - apparent and mean solar time, sidereal time. Twilight, Seasons- causesofseasons (qualitative ideas). International Date Line.

Text Books:

1. *Astrophysics: Stars and GalaxiesK D Abhyankar, Chapter 2*
2. *ASTRONOMY, A Self-Teaching Guide, Dinah L. Moché, Chapter 1*

Sun (5 Hours)

Sun - solar atmosphere and internal structure – Photosphere, chromosphere and corona.

Radiation zone & Convection Zone. Sun spots, Activity Cycles, flares, prominences,

coronal holes, Solar wind.

Text Books:

1. *ASTRONOMY, A Self-Teaching Guide, Dinah L. Moché, Chapter 4,*
2. *Introduction to Astronomy and Cosmology, Ian Morison, Chapter 2*

Galaxies (3 hours)

Galaxies - our galaxy, galaxy types & turning fork diagram. Structure on the largest scaleclusters,super clusters and voids.

Text Book:*Astronomy, A Self-Teaching Guide, Dinah L. Moché,- Chapter 6*

Module III

Astrophysics (14 hours)

Gravitational contraction - Virial theorem, Jeans mass. Energy production inside stars.Thermonuclear fusion. Hydrogen burning. p-p chain. CNO cycle. Evolution of stars – birth– protostar, hydrostatic equilibrium, red giant, late stages of evolution - white dwarfs &Chandrasekhar limit, Neutron stars, Supernovae, Pulsars, Black holes. StellarClassification, H-R diagram - Main sequence stars.

Text Books:

1. *Astrophysics: Stars and GalaxiesK D Abhyankar, Chapter 10,*
2. *ASTRONOMY, A Self-Teaching Guide, Dinah L. Moché , Chapter 5*

Cosmology (12 hours)

Large scale structure of the universe – isotropy and homogeneity. Cosmologicalprinciple.

Standard big bang model - GUT, Planck Epoch, Inflation, Nucleosynthesis,Recombination& CMBR. Expanding universe - red shift. Hubble's law and Hubbleparameter. Age of universe and its determination. Dark energy and Dark Matter(qualitative idea).

Text Books:

1. *ASTRONOMY, A Self-Teaching Guide, Dinah L. Moché, Chapter 7*
2. *Introduction to Astronomy and Cosmology, Ian Morison, Chapter 9*

References:

1. *A short history of the Universe – Joseph Silk*
2. *Introduction to Astronomy and Cosmology, Ian Morison, John Wiley &Sons,Inc.*
3. *Introduction to cosmology- J V Narlikar*
4. *http://www.astro.cornell.edu/academics/courses/astro201/topics.html*
5. *http://www.ualberta.ca/~pogosyan/teaching/ASTRO_122/lectures/lectures.html*
6. *http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html*

Semester VI

PH6B13fB18-INFORMATION TECHNOLOGY

(Choice Based Course)

Credits - 3

Total lecture hours - 54 hrs

Aim and Course overview:

The course enables to learn about the fascinating world of information technology and to use thetools available in Internet and the World Wide Web for a deep study of the subjectsrelated to physics in better way by the students themselves. Prerequisites: Awareness of basic computer operations.

Module I (20 hours)

Information and its Use : Information Technology – Quality of information – Messagetransmission – Electronic Office – E mail – Document storage – Computers in Industry –Different types – Graphical user interface

Text book:*Information Technology – The Breaking Wave", D.Curtin, K.Sen and K.Morin,Tata McGraw Hill, 1999. Chapter – 1, 2*

Computer Networks:

Importance of Networks. Components of Networks. Classificationof Networks: Broad cast networks-Switched networks. Switching Techniques. TypesofNetworks – LAN – MAN – WAN. Networking Models – OSI reference model – TCP/IPreference model-Comparison between the OSI and TCP/IP models. Network Topology –Bus- Star-Ring-Tree-Mesh-Cellular.

Text Books:

1. *Computer Networks, A.S. Tanenbaum - Prentice Hall of India, Chapter – 1*
2. *Computer Fundamentals, P.K. Sinha 3rd Edn. BPB Publications, Chapter – 17*

THE INTERNET:

Internet Protocols – Internet Protocol (IP)-Transmission ControlProtocol (TCP) -Internet Address – Structure of Internet Servers Address-AddressSpace- Services on Internet – Domain Name System-SMTP and Electronic mail – Httpand World Wide Web-Usenet and News groups-FTP-Telnet-Network Security-Digital Signature-E-mail Privacy-Internet Tools – Search Engines-Web browsers-Internet explorer, Netscape Navigator, Mozilla Firefox(Working Knowledge)

Text Books:

1. *Computer Networks, A.S.Tanenbaum - Prentice Hall of India, Chapter –5, 6,7*
2. *Computer Fundamentals, P.K. Sinha 3rd Edn. BPB Publications, Chapter – 18*

Module – II (20 hours)

THE HTML:

What is HTML? Basic Tags of HTML – HTML-TITLE-BODY - Starting anHTML document – The <!DOCTYPE>declaration-setting boundaries with <HTML>-theHEAD element-the BODY element-the STYLE element and the SCRIPT element. -Formatting of text– Headers-Formatting Tags-PRE tag-FONT tag-Special Characters.Working with Images- META tag - Links – Anchor Tag -Lists – Unordered Lists-OrderedLists-Definition Lists -Tables –TABLE, TR and TD Tags-Cell Spacing and Cell Padding-Colspan and Rowspan -Frames –Frameset-FRAME Tag-NOFRAMES Tag - Forms –FORM and INPUT Tag-Text Box-Radio Button-Checkbox-SELECT Tag and Pull DownLists-Hidden-Submit and Reset

Text book: *HTML4 – 2nd Edn. Rick Darnell, Techmedia, Chapter – 1, 2,3,4,5*

Module – III (14 hours)

Basic Idea of DBMS:

Need for Data Base – Database Systems versus File systems -View of Data - Data Abstraction-Instances and Schemas - Data Models – ER Model-Relational Model- Network Model-Hierarchical Model (general ideas) -Basic ideas aboutStructured Query Language.

Text book:*Fundaments of Database System – Elmasri, Ramez and NavatheShamkantB. 4th Edn.Person Education, India, 2004. Chapter – 1*

MS – OFFICE/OPEN OFFICE (Working Knowledge):

Word processors – PowerPoint -Spreadsheets – Databases(No specific text book is preferred. MS office (97, 98, 2000, /Open Office which isinstalled in the lab can be used. Working practice must be given)

References

1. *"Information Technology – The Breaking Wave", D.Curtin, K.Sen and K.Morin,TataMcGraw Hill, 1999.*
2. *Computer Networks – A.S. Tanenbaum - Prentice Hall of India*
3. *Computer Fundamentals – P.K. Sinha 3rd Edn. BPB Publications*
4. *Internet and World Wide Web – Deitel*
5. *HTML4 – 2nd Edn. Rick Darnell, Techmedia*
6. *Database System Concepts – Silberschatz-Korth-Sudarshan 4th Edn – TataMacGraw Hill*
7. *"Information Technology and systems", Green, B.C., Longman Scientific&Technical Publishers, England, 1994.*
8. *Networks – Tirothy S. Ramteke – 2nd Edn. Pearson Edn – New Delhi, 2004*
9. *Data and Computer Communucation, William Stalling, PHI, New Delhi.*
10. *Mastering HTML4 – Ray D.S. and Ray E.J. – BPB*
11. *HTML – The Complete Reference – Tata McGraw Hill*
12. *Fundaments of Database System – Elmasri, Ramez and NavatheShamkant B.4thEdn.v Pearson Education, India, 2004.*

OPEN COURSES

Semester V

PH5D01aB18 Amateur Astronomy

(Open course)

Credits- 4

Total lecture hours- 72hrs

Aim

This course is intended for students of other disciplines. The main objectiveis to introduce the student to the fascinating world of Astronomy. The courseis expected to provide basic ideas and resources to a student who isinterested in getting started with astronomy and give answers to manyintriguing astronomical puzzles.

Course Overview and Context

Astronomy is the study of the stars, planets, and other celestial objects thatpopulate the sky. It is an endlessly fascinating field, the oldest of the naturalsciences, and one of the few areas of science that amateurs can directly assistthe professionals. It is open and accessible for any level of interest andinvolvement from common man to astrophysicists.This course covers fundamental topics like stars, constellations, galaxies,solar system and the universe. It also gives information about the tools of astronomy.

Module 1

Observation of sky (18hrs)

Constellations -Celestial coordinates – Location on the celestial sphere – equatorial co-ordinate system- right ascension and declination - Apparent daily and annual motion of the stars – The ecliptic - Earth'sseasons – Equinoxes and solstices – The solar and sidereal day

Text Book :

1. *Architecture of the Universe -Necia H. Apfel& Allen Hynek-*
2. *The Benjamin Cummings publishing company, Inc.,*

The tools of Astronomy- Optical Telescope - refracting telescope, reflectingtelescope – Resolving power – Magnification – Telescope aberration –Hubble Space telescope – Radio Telescope – GMRT.

Text Book : *Astronomy: A Self-Teaching Guide – Dinah L. Moche, Wiley,6th edn., Chapters 1 and 2.*

Module II

Stars and Galaxies(18hrs)

Distance to stars, Parallax method – Spectra of stars – Spectral classes –temperature – Luminosity – apparent and absolute magnitudes – H – RDiagram -Galaxy – Milky Way- classification of galaxies - Cluster of galaxies.

Stellar Evolution – Life cycle of stars – birth, lifetimes, Shining stars, Oldage – Red giants – synthesis of heavier elements – Variable stars – Death –Mass Loss – White dwarfs – Exploding stars – Supernova – Neutron stars –Black holes

Text Book : *Astronomy : A Self-Teaching Guide – Dinah L. Moche, Wiley,6th edn., Chapters 3, 5 and 6.*

Module III

The Solar system (18 hrs)

The sun- distance and size – structure – Rotation - surface – sunspots –Activity cycles – Magnetism – Flares and coronal mass ejections – Solar wind -Planets – Brief history and Origin – Laws of planetary motion – Comparison of Planets - Mercury – Venus – Earth – Mars – Jupiter – Saturn – Uranus –Neptune (Structure, atmosphere, Surface features – Moons of all planets) - Moon- rotation, size, density – Surface features – Craters, Mountains – Structure - Lunar and solar eclipse - Minor members of the solar system- Asteroids, comets and meteors

Text Book: *Astronomy: A Self-Teaching Guide – Dinah L. Moche, Wiley,6th edn., Chapters 4, 8, 9, 10 and 11*

Module IV

Our universe (18hrs)

Early models of universe- Earth at the centre- Aristotle- Ptolemy- a spinning earth- unanswered questions- Sun at the centre- Copernican model. Planetary paths- Beyond the eye- Galileo and his observations - Starry messenger- force of gravity.

Text Book :*Architecture of the Universe -Necia H. Apfel & Allen Hynek-The Benjamin Cummings publishing company, Inc., (ch- 3, 4, 8& 9)*

The expanding universe- Hubble's law - Big bang theory – Steady state theory - age and size of universe. Extraterrestrial Life, SETI (Search for extra-terrestrial intelligence) – Space Travel

Text Book :*Astronomy : A Self-Teaching Guide – Dinah L. Moche, Wiley,6th edn., Chapters 7 and 12*

References

1. *Concepts of Contemporary Astronomy – Paul W. Hodge, McGraw _ Hill*
2. *Astronomy: A Beginners Guide To The Universe - Steve Mcmillan andEric Chaisson, Pearson Education*
3. *Understanding the Universe, James B. Seaborn, Springer*
4. *Elements of Cosmology, Jayant V. Narlikar, Universities Press*
5. *Introduction to Astrophysics. BaidyanathBasu:,Prentice-Hall of IndiaPvt. Ltd*
6. *Astrophysics of the Solar System, K. D. Abhyankar ,Universities Press*
7. *Chandrasekhar and his limit – G Venkataraman, University Press*

Competencies

- Define constellations.
- Understand the location of stars with the help of celestial coordinates.
- Compare the apparent daily and annual motion of the stars.
- Explain the seasons on Earth.
- Define a sidereal day and solar day and explain why they differ.
- Compare the working of optical telescopes.
- Define resolving power and magnification with respect to a telescope.
- Discuss the defects in a telescope.
- Describe Hubble space telescope.
- Explain how radio telescopes work with the example of GMRT.
- Describe the parallax method for determining the distance to stars.
- Give a general description of the stellar spectra and how they aredivided into spectral classes.
- List the different kinds of information that are obtained from stellarspectra.
- Distinguish between apparent and absolute magnitude.
- Describe the H – R diagram.

- Define a galaxy and discuss about milkyway.
- Classify the different galaxies and discuss about them.
- Define a cluster of galaxies.
- Describe the different stages in the life cycle of a star.
- Compare and contrast the final stages of the life cycle of stars ofdifferent masses.
- List the basic physical dimensions of the sun.
- Sketch the structure of the sun and identify and describe the differentregions.
- Describe the Sun's rotation and magnetic field.
- Describe the origin, properties and cyclic nature of sunspots and explain how they are related to solar activity.
- Describe the surface of the sun and compare and contrast the nature of different features that originate from the surface
- State Kepler's laws of planetary motion.
- Compare and contrast the general properties, surface conditions, atmospheres and moons of the 8 planets.
- List the physical parameters of the moon.
- Describe the general surface features of the moon.
- Explain the current model of moon's internal structure.
- Differentiate and describe lunar and solar eclipses.
- Discuss about the minor members of the solar system.
- Discuss about the early models of the universe and differentiate them.
- Explain what is meant by starry messenger.
- Specify the reasons for the idea that the universe is expanding.
- State the Hubble's law.
- Discuss the theories about the evolution of the universe.
- Discuss how one can estimate the age and size of the universe.

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Semester V Open Course

PH5D01aB18 Amateur Astronomy

Module	**Hours 72**	**Marks 2**	**Marks 5**	**Marks 15**	**Total 80**
		10/12	6/9	2/4	
I Observation Of sky	18	3	2	1	31
II Stars and Galaxies	18	4	2	1	33
III Solar system	18	4	2	1	33
IV Our Universe	18	1	3	1	32

Semester-V

PH5D01bB18 - PHYSICS IN DAILY LIFE

(Open Course)

Credits-3

Total Lecture hours - 72 Hrs

Aim

This course is intended for students of other disciplines. The main objective of this course is to help the students to understand the basic principles in Physics and to view the objects around them with the view of a physicist. The course is expected to provide basic ideas and resources to a student who is interested in Physics and to unveil the fascinating world of Physics around him ranging from the concave and convex mirrors to the twinkling stars and the universe.

Course Overview and Context

Physics is one of the oldest of the academic disciplines and is a fascinating field which shapes our everyday life. Physics is there everywhere and we use the principles of Physics in everyday life without really understanding it. Physics account for all the phenomena such as heat, light, electricity, magnetism etc and it also includes astronomy which deals with celestial bodies and our universe. This course covers topics like fundamental quantities, light, heat, matter, energy etc and also a module on astrophysics. The course aims to make the students curious about Physics in everyday life.

Module I (20 hours)

Unit 1 (8 hours)

Fundamental and derived quantities. Units and dimensions, dimensional analysis, order of magnitude, significant figures, errors.

Unit 2 Light (12 Hours)

Reflection, refraction, diffraction, interference, scattering(elementary ideas only) – examples from daily life – apparent depth, blue color of sky, twinkling of stars.

Total internal reflection, mirage, sparkling of diamond, primary and secondary rainbow – optical fibers. Concave and convex mirrors, lenses – focal length, power of a lens, refractive

index, prism, dispersion. Human eye, defects of the eye – myopia, hypermetropia, presbyopia and astigmatism and their correction by lens.

Module II (22 hours)

Unit 3 Motion (12 Hours)

Velocity, acceleration, momentum, Idea of inertia, force - laws of motion. Newton's law of gravitation, acceleration due to gravity, mass and weight, apparent weight, weightlessness. Rotational motion, Moment of inertia, torque, centripetal and centrifugal acceleration examples- banking of curves, centrifugal pump, roller coasters.

Unit 4 Electricity (10 Hours)

Voltage and current, ohms law. Electric energy, electric power, calculation of energy - requirement of electric appliances – transformer, generator, hydroelectric power generation – wind power – solar power – nuclear power

Module III (30 hours)

Unit 5 Matter and energy (18 Hours)

Different phases of matter, fluids - surface tension, viscosity- capillary rise, Bernoulli's theorem and applications -Heat energy, temperature, different temperature scales – degree Celsius, Fahrenheit and Kelvin.

Waves – transverse and longitudinal waves, sound waves, Doppler Effect.

Lasers, fluorescence, phosphorescence, electromagnetic waves – applications – microwave oven, radar, super conductivity.

Unit 6 Universe (12 hours)

Planets, – solar system, moon- phases of moon, lunar and solar eclipses, constellations, Different types of stars, Galaxies, black hole. Satellites, Artificial satellites, Global positioning system. Geo stationary satellite.

Reference Texts

1. Fundamentals of Physics with Applications by Arthur Beiser

2. Conceptual Physics by Paul G Hewitt

Semester-V

PH5D01cB18 - COMPUTER HARDWARE AND NETWORKING

(Open Course)

Credits - 3

Total Lecture hours - 72 Hrs

Aim

This course is intended for students of other disciplines. The main objective of this course is to introduce the student to the area of computer hardware and networking. The increasing use of computers, laptops and internet has expanded the scope of this subject.

Course overview and context

Computer Hardware and networking sector is expanding tremendously in the last two decades, as computers, laptops and internet has become an inevitable part of our life. Computer hardware is the combination of different physical parts of a computer such as hard disks, printers, keyboards etc. Networking involves linking a group of two or more computer systems for the purpose of sharing information and data. This course covers the topics like microprocessor, data storage devices, installation of softwares and also installation of Pascal, C, Oracle, Visual Basic etc.

Module I (24 hours)

Microprocessors – Basic concepts of Intel 80186, 80286, 80386, 80486 and Pentium processors. Motherboard, Expansion buses, Memory, upgrading / adding memory, BIOS Motherboard – removing, installing / configuring motherboards, BIOS set up, troubleshooting memory.

Module II (24 hours)

Data storage devices, IDE and SCSI controllers, hard disk, installing / upgrading CD ROM drives, DVD, Optical storage, Tape back – ups. Printers, Keyboards, pointing and positioning devices, digital camera, Scanners, Monitors, Hard disks- installing / upgrading, troubleshooting, formatting, Error codes, BIOS disk routines

Module III (24 hours)

Multimedia, Graphical accelerators, audio, modems, I/E add on, Networks, Power supplies, UPS Printer installation, Software installation – DOS, Windows 95, 98, Linux, WindowsNT

– installation, Administration, Installing PASCAL, C, ORACLE, VISUAL BASIC, Software diagnostics – PC tools, Norton utilities, XT/AT diagnostics, Viruses and anti-viruses.

References:

1. IBM PC and CLONES- Hardware, troubleshooting and maintenance – B Govindarajalu

2. PC Hardware, a beginners guide – Ron Gilster

3. All about Motherboard: - Manahar Lotia, Pradeep Nair

PH2BP01B18 - Mechanics, Properties of Matter and Optics I

Core Practical I (1st Year)

Credit - 2

No. of hours: 72

1. Cantilever – Young's modulus of material of bar- Scale & Telescope
2. Uniform bending – Pin and Microscope – Determination of Young's modulus
3. The Torsion Pendulum – Rigidity modulus of material of wire.
4. Symmetric Compound Pendulum-Determination of radius of gyration(K) and Acceleration due to gravity (g)
5. Static torsion- Rigidity modulus
6. Measurement of density of a solid – Sensibility method to find mass using beam balance and screw gauge / verniercalipers for dimension measurements
7. Viscosity of a liquid -Variable pressure head
8. Viscosity- Stoke's method
9. Sonometer – Verification of laws, Measurement of density of solid.
10. Lee's Disc – Thermal Conductivity.
11. Surface tension - Capillary rise method
12. Quincke's method – Determination of surface tension
13. Liquid Lens- Refractive index of Liquid
14. Spectrometer- Refractive Index of material of Prism
15. Air wedge-Diameter of wire
16. Spectrometer- Small angled prism-Refractive index of material of prism (Supplementary angle method)
17. Vertical oscillations of a spring – Determination of Young's modulus
18. One dimensional elastic collision – Hanging sphere method – Law of conservation of energy and momentum

PH4BP02B18- Mechanics, Properties of matter and Optics II

Core Practical II (2nd Year)

Credit: 2

No. of hours : 72

1. Fly Wheel – Moment of Inertia
2. Cantilever- pin & microscope –Determination of Young's modulus
3. Torsion pendulum- n and I - using two identical masses
4. Uniform bending – Young's Modulus-Optic lever method.
5. Non Uniform Bending - Young's modulus of material of bar.
6. Non Uniform bending – Optic Lever – Determination of Young's modulus
7. Young's Modulus –Koenig's method
8. Asymmetric Compound Pendulum – Acceleration due to gravity, radius of gyration & moment of inertia.
9. Viscosity-constant pressure head- coefficient of viscosity (η) of the liquid
10. Viscosity- Searle's rotation viscometer method
11. Liquid lens-Optical constants of a convex lens
12. Kater's pendulum-g
13. Spectrometer – Refractive index of liquid.
14. Spectrometer – i-d curve
15. Thermal conductivity of rubber
16. Kundt's tube- Velocity of sound
17. Specific heat of liquid –Newton's law of cooling
18. Newton's rings-Determination of wavelength.

PH6BP03B18- Electricity& Magnetism

Core Practical III (3rd Year)

Credit - 2

No. of hours -72

1. Melde's String – Measurement frequency
2. A.C Sonometer- Frequency of a.c.
3. Field along the axis of circular coil-Moment of magnet (null method)
4. Field along the axis of a coil-Variation of magnetic field along the axis of a circular coil
5. Searle's Vibration Magnetometer – Moment of magnet.
6. Electro chemical equivalent of copper.
7. Potentiometer – Resistivity of the given wire.
8. Potentiometer – Calibration of low range voltmeter.
9. Potentiometer-Calibration of low range ammeter
10. Potentiometer-Calibration of high range voltmeter.
11. Carey Foster's Bridge-Measurement of resistivity
12. Carey Foster's Bridge – Temperature coefficient of Resistance.
13. Conversion of Galvanometer in to ammeter
14. Conversion of Galvanometer into voltmeter
15. LCR circuit analysis-Series, parallel and Q-factor
16. Mirror Galvanometer-Figure of merit
17. B.G-charge sensitivity–Standard capacitor method
18. B.G.–Measurement of high resistance by leakage method
19. Verification of Thevenin's and Norton'stheorem
20. Deflection and Vibration Magnetometer-m &Bh
21. e/m–Thomson's apparatus-Bar magnet/magnetic focusing
22. B.G-Measurement of capacitance

PH6BP04B18 - Electronics and Microprocessors

Core Practical IV (3rd Year)

Credit - 2

No. of hours -72

1. Diode Characteristics – Knee voltage, dynamic & static resistances.
2. Zener characteristics – forward and reverse – Study of dynamic and static properties
3. Transistor characteristics – Common Emitter Configuration
4. Half wave rectifier – Study of ripple factor and load regulation with and without filter circuit
5. Full wave rectifier – (center tap) – Study of ripple factor and load regulation with and without filter circuit
6. Full wave rectifier – (bridge) – Study of ripple factor and load regulation with and without filter circuit
7. FET – characteristics – Determination of parameters
8. Voltage regulator using zener diode – Study of line and load regulations
9. Regulated power supply–Transistor and Zenerdiode
10. Clippers – positive, negative and biased – Study of output waveforms
11. Clampers – positive, negative and biased – Study of output waveforms
12. Voltage multiplier-Doubler and Tripler.
13. OPAMP characteristics – Study of CMRR and open loop gain
14. OPAMP – inverter, non inverter and buffer – Study of gain
15. Op-Amp-Adder and Subtractor
16. LC Oscillator – Colpit's /Hartley – using transistor
17. Phase shift oscillator – using transistor
18. 8085Microprocessor-BCDadditionandsubtraction
19. 8085Microprocessor–multiplication of two eight bit numbers with result 16 bit.
20. 8085Microprocessor–sortinginascendinganddescendingorder.

PH6BP05B18 – Spectroscopy, Laser and Computer Programming

Core Practical V(3rd Year)

Credit - 2

No. of hours -72

1. Spectrometer–Grating-wavelength
2. Spectrometer-prism-Dispersive power
3. Spectrometer-prism-Resolving Power
4. Spectrometer-Grating Resolving Power
5. Spectrometer- Grating – Dispersive power
6. Spectrometer–Cauchy'sconstants
7. Laser-Determinationofwavelength
8. Ultrasonic-Determination of velocity of ultrasonic waves
9. Single slit– Diffraction using Laser
10. Optical fiber – Determination of numerical aperture
11. Laser – Determination of spot size and divergence
12. Computer programming – Simple Pendulum –Calculation of 'g' from experimental data.
13. Computer programming – Solving differential equation – Runge kutta method – II order.
14. Computer programming – Multiplication of any two matrices- (m x n) and (n x q)
15. Computer programming–Conversion of temperature scale
16. Computer programming–sorting the numbers in ascending and Descending order C++
17. Computer programming–Solving a quadratic equation
18. Computer programming–Solving a linear equation-Bisection method.
19. Computer programming–Solving an equation by Newton–Raphson method
20. Computer programming-Generation of Fibonacci series

PH6BP06B18 - Digital and Advanced Electronics

Core Practical IV (3rd Year)

Credit - 2

No. of hours -72

1. Gates – AND, OR & NOT – Truth table verification.
2. Sweep Generators – ON & OFF state.
3. Universal gates IC–NAND,NOR-Realize basic gates from universal gates.
4. BCDto7segmentdecoder(IC)
5. Astable multivibrator –using transistor
6. Monostable multivibrator- using transistor
7. Monostablemultivibrator–IC555
8. RegulatedpowersupplyusingIC741
9. Wave shaping RC circuits-Integrator and differentiator
10. Regulatedpowersupply-UsingIC's-LM7805,7905,7809,7909,7812,7912
11. Construction and measurement of a dual Regulated power supply with filter.
12. R.C. Coupled amplifier-Gain
13. Amplitude modulation
14. Pulse width modulation
15. Ringcounterusing74194and74151
16. Astablemultivibrator–IC555
17. D/A Converter using IC
18. 4bitShiftregister
19. Flip-Flop–R.S
20. J.K Flip-Flop
21. Schmitttriggerusing7414

References:

1. *Properties of Matter-D.S. Mathur*
2. *Optics-Subramanyan & Brijlal*
3. *Electricity &Magnetism-Sreevastava*
4. *Laboratory manual for electronic devices and circuits-David A Bell*

5. *Electronic Laboratory Primer-A design approach-S PoornaChandra and B Sasikala.*
6. *A text book of practical Physics_ InduPrakash and Ramakrishnan.*
7. *Advanced course in Practical Physics by D Chattopadhyay*
8. *Practical Physics – Joseph Ittiavirah, Premnath and Abraham(2005)*
9. *Practical Physics, CL Arora, S.Chand*
10. *Practical Physics, Harnam Singh , S Chand*
11. *Electronics lab manual Vol 1 & 2, K ANavas.*
12. *A course of Experiments with He –Ne Laser – R.S Sirohi (2nd Edition) Wiley Eastern Ltd.*
13. *Electronics lab manual Vol 1 & 2, Kuryachan T D and Shyam Mohan S, Ayodhy*

SYLLABUS FOR COMPLEMENTARY PHYSICS FOR MATHEMATICS

Semester: I

PH1C01B18: PROPERTIES OF MATTER & ERROR ANALYSIS

(Complementary Course for B.Sc. Mathematics)

Credits: 2

Total lecture hours -36 hrs

Aim:

This course will try to provide conceptual understanding of basic physics to students and will provide a theoretical basis for doing experiments in related areas.

Course Overview:

This course exposes students to basic physics. It helps to understand basic phenomena in Physics such as Elasticity, Surface tension and hydrodynamics. As we know, no measurement of a physical quantity can be entirely accurate and it is important to have knowledge about the deviations of measured quantity from true value. Brief discussions about how errors are reported, the kinds of errors that can occur, how to estimate random errors, and how to carry error estimates into calculated results are included as a part of this course. Module I deals with elasticity. Module II is divided into hydrodynamics and surface tension. Module III handles error analysis.

Module I

Elasticity (13 hours)

Stress- strain- Hooke's law- Elastic moduli- Poisson's ratio- twisting couple determination of rigidity modulus- static and dynamic methods- static torsion- torsion pendulum, bending of beams- cantilever, uniform and non-uniform bending, I section girder.

Text Book:*Mechanics - D. S. Mathur- Revised by P. S. Hemne, S. Chand &Co., Chapters 13 & 14.*

Module II

Surface tension (3 hours)

Molecular theory of surface tension - surface energy - excess pressure in a liquid drop, factors affecting surface tension – applications

Text book:*Properties of Matter- Brijlal and N. Subrahmaniam, S. Chand&Company Pvt. Ltd,1989, Chapter 8*

Hydrodynamics (7 hours)

Streamline and turbulent flow - critical velocity - Coefficient of viscosity - Derivation of Poiseuille's equation, Stokes equation-Determination of viscosity by Poiseuille's method - Brownian motion – Viscosity of gases – Bernoulli's theorem.

Text Book: *Mechanics– Prof. D.S Mathur Revised by: Dr. P.S Hemne. , SChand & Company Pvt. Ltd, chapter 15*

Module III (13 hours)

Error Analysis

Basic ideas – uncertainties of measurement – importance of estimating errors – dominant errors – random errors – systematic errors - rejection of spurious measurements. Estimating and reporting errors – errors with reading scales, errors of digital instruments – number of significant digits –absolute and relative errors – standard deviation. Propagation of errors – sum and differences – products and quotients – multiplying by constants – powers.

Text Book:

1. An Introduction to Error Analysis: The Study of Uncertainties
in Physical Measurements, John R. Taylor - Univ. Science Books
2. http://www.upscale.utoronto.ca/PVB/Harrison/ErrorAnalysis/
3. http://phys.columbia.edu/~tutorial/index.html

References:

1. Elements of properties of matter, D S Mathur
2. Advanced course in Practical Physics by D Chattopadhyay
3. Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)
4. Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)
5. Modern Physics- G. Aruldas and P. Rajagopal (PHI Pub)
6. Physics- Resnick and Halliday
7. An Introduction to Error Analysis: The Study of Uncertainties Measurements, John R.Taylor – Univ. Science Book

Competencies

- State Hooke's law
- Categorize different types of elasticity
- Define Poisson's ratio
- Establish the relation between volume strain and linear strain
- Define twisting couple on a cylinder, angle of twist and angle of shear
- Identify bending moment,
- Discuss the cases of bending of beams in cantilever, centrally loaded
- supported beam
- Introduce Molecular theory of surface tension and surface energy-
- Calculate excess pressure in a liquid drop or an air bubble in a liquid
- Determine the velocity of transverse waves on liquid surface
- Mention factors affecting surface tension
- Distinguish stream line and turbulent flow
- Define Critical velocity,
- State the significance of Reynold's Number
- Derive Poiseuille's equation for a liquid flowing through a narrow tube
- Illustrate the calculation of coefficient of viscosity of a viscous liquid
- Obtain Meyer's formula
- Statement of Bernoulli's theorem.
- Identify Basic ideas regarding uncertainties of measurement
- Mention importance of estimating errors
- Classify errors
- Investigate Estimating and reporting of errors
- Clarify errors with reading scales, errors of digital instruments
- Write down the number of significant digits
- Calculate absolute, relative errors, standard deviation
- Represent error bars
- Compute propagation of errors in sum, differences, products, quotients,
- multiplication by constants, power of a measured quantity

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PH1C01B18: PROPERTIES OF MATTER & ERROR ANALYSIS

Module	**Hours** **36**	**Marks** **1**	**Marks** **5**	**Marks** **10**	**Total** **60**
		10 / 12	**6/9**	**2/4**	
I Elasticity	13	5	2	2	35
II Surface Tension and Hydrodynamics	10	2	3	1	27
III Error Analysis	13	5	4	1	35

MODEL QUESTION PAPER

PH1C01B18: PROPERTIES OF MATTER & ERROR ANALYSIS

(Complementary Course for B.Sc. Mathematics)

Time : 3 hours Maximum Marks : 60

Part A

Very Short Answer Questions.

Answer **any ten** *questions briefly. Each question carries* ***1*** *mark.*

1. What do you mean by elastic limit of a material?
2. Define neutral surface of a beam?
3. What is meant by flexural rigidity of a beam? Write the expression for flexural rigidity?
4. Explain Young's modulus of elasticity?
5. What is Poisson's ratio?
6. State Bernoulli's theorem?
7. Distinguish between stream line flow and turbulent flow?
8. Define random error and gross error?
9. Explain the term spurious errors?
10. What is fractional error?
11. Explain how repeated measurements tend to reduce errors.
12. What do you mean by standard deviation?

Part B

Answer **any six** *questions. Each question carries 5 marks*

13. Two identical wires of steel and copper are stretched by the sameweight in turn. Calculate the ratio of the extensions produced in the wire. Y for steel and Cu are 2 $x10^{11}$ and 1.2 $x10^{11}$ N/m2 respectively.
14. A cantilever shows a depression of 0.5 cm at the loaded end. What is the depression at its midpoint?

15. Calculate the work done in blowing a soap bubble of radius 10^{-2} m to a radius 10^{-1} m. Surface Tension of soap bubble is 27 $x10^{-3}$ N/m.
16. Water is conveyed through a horizontal tube 8cm in diameter and 4 km in length at a rate of 20 litre per second. Assuming only viscous resistance, calculate the pressure required to maintain this flow.
17. Calculate the mass of water flowing in 10 minutes through a horizontal capillary tube of 0.1 cm in diameter, 40 cm long if there is a constant pressure head of 20 cm of water. The coefficient of viscosity of water is 8.9 x 10^{-4} Pa.
18. A rectangular board is measured with a scale having accuracy of 0.2 cm. The length and breadth are measured as 35.4 cm and 18.5 cm respectively. Find the relative error of the area calculated.
19. Convert the errors in the following measurements of the velocities of two carts on a track into fractional errors and percent errors (a) v= 55 ± 2 cm/s (b) u= -20 ± 2 cm /s. (c) a cart's kinetic energy is measured as 4.58 ± 2%.
20. Explain different types of errors.
21. Two clocks are showing different time at a place. One is sundial and the other is a Quartz clock. Which clock shows correct time? Why?

Part C

Answer any **two** *questions. Each question carries 10 marks*

22. What is meant by torsional couple. Derive an expression for the couple per unit twist of a cylindrical rod.
23. Define a cantilever. Obtain an expression for the depression produced at its free end when the weight of the beam is negligible.
24. Derive Poiseuille's equation for a liquid flowing through a narrow tube.
25. Discuss the computation of errors in multiplication, division and in powers and roots. Describe the necessity of estimating errors.

Semester II

PH2C01B18: MECHANICS AND ASTROPHYSICS

(Complementary Course for B.Sc. Mathematics)

Credits: 2

Total lecture hours - 36 hrs

Aim:

This course will try to provide conceptual understanding of basic mechanics and crystallography to students and will provide a theoretical basis for doing experiments in related areas.

Course Overview:

This course exposes students to basic physics of rotational dynamics, oscillations and waves. Further this course includes topic of astrophysics to provide understanding about stars.

Module I

Motion under Gravity (5 hours)

Velocity- acceleration- force – acceleration due to gravity - compound pendulum (symmetric and asymmetric) radius of gyration – Kater's Pendulum- centripetal acceleration and force - centrifugal force

Textbook:

Elements of properties of matter, D S Mathur- S Chand, chapter 6

Rotational Dynamics (10 hours)

Angular velocity- angular momentum- torque- conservation of angular momentum, angular acceleration- moment of inertia- parallel and perpendicular axes theorems moment of inertia of rod, ring, disc, cylinder and sphere- flywheel

Textbook:

Mechanics- D S Mathur,(revised edition 2012), Chapter 11

Module II

Oscillations (9 hours)

Periodic and oscillatory motion- simple harmonic motion- differential equation, expression for displacement, velocity and acceleration- graphical representation- energy of a particle executing simple harmonic motion - damped oscillation- forced oscillation and resonance.

Textbook: *Mechanics- D S Mathur,(revised edition 2012), Chapter 7,8.*

Waves (4 hours)

Waves-classifications- progressive wave- energy of progressive wave- superposition of waves-theory of beats- Doppler Effect.

Textbook: *Mechanics- D S Mathur,(revised edition 2012), Chapter 10*

Module III

Astrophysics (8 hours)

Temperature and color of a star- elements present in a stellar atmosphere- mass of star life time of a star- main sequence stars-HR diagram- evolution of stars- white dwarf -supernova explosion- neutron star- black hole- (all topics to be treated qualitatively)

Textbooks: *An Introduction to Astrophysis- Baidyanath Basu, Chapter 2,3,4.*

Astronomy : A self teaching Guide- Dinah L Moche, Wiley 6th Edition, Chpater 7,12.

References

1. Elements of properties of matter, D S Mathur Mechanics- H.S.Hans and S.P.Puri. (TMH)

2. Mechanics, D S Mathur

3. Modern Physics- R. Murugeshan, Er. Kirthiga Sivaprasad

4. A text book on oscillations waves and acoustics, M.Ghosh , D Bhattacharya

5. Introduction to Astrophysics-Baidyanath Basu.

6. Mechanics by D.S. Mathur and P.S. Hemne, S. Chand.

7. Waves, Mechanics & Oscillations- S B Puri

Competencies

- Give the idea of acceleration due to gravity.
- Discuss about symmetric and asymmetric compound pendulum.

- Define radius of gyration.
- Introduce centripetal acceleration.
- Distinguish between centripetal and centrifugal force.
- Describe torque.
- Describe angular momentum.
- Describe angular impulse.
- Describe moment of inertia.
- Describe radius of gyration.
- Determine the relationship between torque and angular momentum.
- Determine the relationship between torque and moment of inertia.
- Determine the relationship between torque and angular acceleration.
- State and prove parallel and perpendicular axes theorems.
- Determine the moment of inertia of following shapes, (i)Uniform Rod (ii) Rectangular
- lamina (iii) thin circular ring (iv) circular disc (v) annular ring (vi) solid cylinder (vii) hollow cylinder (viii)Spherical shell, sphere and hollow sphere.
- Describe flywheel.
- Design an experiment to determine moment of inertia of flywheel
- Define Simple Harmonic Motion with examples
- Set up differential equation of Simple Harmonic Motion
- Describe velocity and acceleration of harmonic oscillator
- Recognize the phase relationship between displacement, velocity and
- acceleration of harmonic oscillator
- Explain the Potential, Kinetic and total energies of harmonic oscillator
- Draw the variations of Potential, Kinetic and total energies with amplitude.
- Classify different types of harmonic oscillator.
- Set up and solve the differential equation of damped harmonic oscillator
- Illustrate overdamped, underdamped and critically damped cases
- Set up and solve the differential equation of forced harmonic oscillator.
- Describe amplitude and velocity resonance.
- Describe sharpness of resonance.

- Classify types of waves
- Recognize wavelength, frequency and wave number
- Obtain the equation for a plane progressive harmonic wave
- Explain distribution of energy in a plane progressive wave
- Extend the theory beats to concerned problems
- State Doppler effect
- Introduce the relation between temperature and color of a star
- Discuss about the elements present in stellar atmosphere.
- Describe main sequence stars along with the H – R diagram.
- Describe the different stages in the life cycle of a star giving an idea about white dwarf, super nova explosion, neutron star and black hole.
- Compare and contrast the final stages of the life cycle of stars of different masses.

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PH2C01B18: MECHANICS AND ASTROPHYSICS

Module	**Hours** **36**	**Marks** **1**	**Marks** **5**	**Marks** **10**	**Total** **60**
		10 / 12	**6/9**	**2/4**	
I Motion under gravity and Rotational dynamics	15	5	3	2	40
II Oscillations and waves	13	5	4	1	35
III Astrophysics	8	2	2	1	22

Semester: III

PH3C01B18 - MODERN PHYSICS, BASIC ELECTRONICS AND DIGITAL ELECTRONICS

(Complementary Course for B.Sc. Mathematics)

Credits: 3

Total lecture hours - 54 hrs

Aim:

The aim of the course is to make the students aware of the basic principles in science leading to latest emerging technologies. Electronics industry is an evolving field based upon the advancements in the Semiconductor Physics. Spectroscopy and Radioactivity are another major fields to obtain finer details of the materials.

Course Overview:

The first module of the course introduces the students to basic structure of matter and its interaction with radiation. It also gives an introductory idea about Quantum Mechanics and Nuclear Physics. The course also covers the basics of semiconductor physics.

Module I (16 hours)

Atom models & Spectroscopy (16hrs)

Thomson's model - Rutherford's nuclear atom model (qualitative) - Bohr atom model – Bohr radius – total energy of the electron – Bohr's interpretation of Hydrogen atom- Sommerfeld's relativistic atom model – elliptical orbits of Hydrogen (qualitative) – Sommerfeld's relativistic theory – fine structure of Hα line - Vector atom model – quantum numbers associated with vector atom model – coupling scheme (qualitative) - optical spectra – spectral terms – spectral notation – selection rules.

Molecular spectra – theory of origin of pure rotational spectra of rigid diatomic molecule - Raman effect – experimental study of Raman effect – quantum theory of Raman effect-- fluorescence and phosphorescence.

Text Book: *Modern Physics, R. Murugeshan, S. Chand and Co. 18thEdn, Chapter 6,19*

Module II (20 hours)

Quantum mechanics (12 hrs)

Introduction – breakdown of classical physics – black body radiation and Planck's quantum hypothesis (qualitative) – photoelectric effect – Einstein's explanation of photoelectric effect – de Broglie hypothesis – matter wave – Davisson Germer experiment – uncertainty principle (derivation and application not required) - wave packet – wave function – properties of wave function – probabilistic interpretation of wave function – normalisation condition – time independent Schrödinger equation – particle in a box problem.

Text Books:

1. *Modern Physics, G. Aruldhas and P. Rajagopal, Tata McGraw-Hill, 5thedn.*
2. *Quantum Mechanics, Aruldhas, PHI Pub.*
3. *Modern Physics , Arthur Beiser, Tata McGraw-Hill*

Nuclear Physics (8hrs)

Classification of nuclei - general properties of nucleus - binding energy - nuclear stability - theories of nuclear composition - nuclear forces - magic numbers - natural radioactivity - alpha- beta & gamma rays - properties of alpha rays - properties of beta rays - properties of gamma rays- fundamental laws of radioactivity – Soddy Fajan's displacement law - law of radioactive disintegration – half life - mean life - units of radioactivity - law of successive disintegration - radioactive dating.

Text Book:*Modern Physics , R Murugeshan, KiruthigaSivaprasath, S. Chand and Co., Chapter 27- sections:27.1 to 27.7 & 27.10, Chapter 31- sections:31.1 to 31.5, 31.29 to 31.31 & 31.33 to 31.35.*

Module III (18 hours)

Basic Electronics (11 hrs)

Energy bands in solids - conduction in solids – semiconductors - majority and minority charge carriers - intrinsic conduction. PN junction diodes – biasing - diode equation (derivation not required), diode parameters, diode ratings - diode characteristics - junction

break down. Rectifiers - half wave, full wave and bridge rectifiers. Zener diode characteristics – voltage regulation. Bipolar junction transistors – biasing - transistor currents - transistor circuit configurations - common emitter configurations.

Text Book: *Basic Electronics , B. L. Theraja - Chapter12 (12.17, 12.20, 12.22, 12.23-26, 12.30), Chapter 13, Chapter14, Chapter15(15.1-2), Chapter 18 (18.1-18.8).*

Digital electronics (7 hrs)

Different number systems – decimal - binary – octal - hexa decimal number systems – conversion between different number systems – binary mathematics – addition and subtraction – basic theorems of Boolean algebra – de Morgan's theorems – AND, OR, NOT, NAND, NOR, XOR gates – truth tables – half adder and full adder (qualitative).

Text Book :*Digital principles and applications, A. P. Malvino and P.Leach*

References:

1. *Concepts of Modern Physics- A. Beiser , Tata McGraw-Hill, 5th Edn.*
2. *Modern Physics, G. Aruldas and P.Rajagopal , PHI Pub.*
3. *Quantum Physics- S. Gasiorowicz (John Wiley & Sons)*

Competencies:

- Discuss Thomson's and Rutherford's atom models
- Discuss the Bohr's atom model
- Calculate the Bohr radius and total energy of an electron
- Explain Bohr's interpretation of Hydrogen atom
- Discuss Sommerfeld's atom model
- Discuss vector atom model
- Explain quantum numbers in vector atom model
- Understand the coupling schemes and selection rules
- Understand the molecular spectra
- Explain the Raman effect and illustrate quantum theory to explain the effect

- Understand the inefficiency of classical mechanics
- Explain black body radiation
- State Planck's quantum hypothesis of black body radiation
- Define photoelectric effect
- Discuss Einstein's explanation of black body radiation
- Define de Broglie hypothesis
- Define uncertainty principle
- Discuss Davisson Germer experiment
- Define wavefunction
- List the properties of wavefunction
- Explain time independent Schrodinger equation
- Discuss particle in a box problem
- Mention different types of nuclei.
- Describe the properties of nucleus.
- Explain Binding energy.
- Calculate binding energy of nucleus.
- Describe Nuclear stability.
- State electron- proton hypothesis.
- State proton- neutron hypothesis.
- Describe nuclear force.
- Mention the features of nuclear force.
- List magic numbers.
- Explain natural radioactivity.
- Describe the experimental set up.
- Focus and distinguish between Properties of Alpha, Beta & Gamma rays.
- State Soddy Fajan's displacement law.
- State law of radioactive disintegration.
- Determine the mean life of radioactive material.
- Define Units of radioactivity- Curie & Rutherford.
- Determine the age of earth.

- Determine the age of biological specimen – carbon dating.
- Define Q value.
- Calculate threshold energy of an endoergic reaction.
- Understand the conduction in solids
- Discuss p-n junction diode
- Explain diode characteristics
- Discuss rectification process
- Understand the working of Zener as a voltage regulator
- Define thermal run away
- Relate α, β and γ
- Explain different types of transistor configurations
- List different number systems
- Discuss the binary addition and subtraction
- Explain the conversional between decimal, binary, octal and hexadecimal number systems
- Describe the working of different types of logic gates
- Draw half adder and full adder circuits.

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PH3C01B18 - MODERN PHYSICS, BASIC ELECTRONICS AND DIGITAL ELECTRONICS

Module	**Hours**	**Marks 1**	**Marks 5**	**Marks 10**	**Total 60**
		10 / 12	**6/9**	**2/4**	
I Atom models Spectroscopy	16	4	3	1	29
II Quantum Mechanics Nuclear Physics	20	6	2	2	36
III Basic Electronics Digital Electronics	18	2	4	1	32

Semester: IV

PH4C01B18: PHYSICAL OPTICS, LASER PHYSICS AND DIELECTRICS

(Complementary course for Mathematics**)**

Credits: 3

Total Lecture Hours: 54

Aim

The syllabus is expected to provide a comprehensive knowledge and understanding of physics that will cater to the basic requirements for his/her higher studies. It also aims to make the learner to have knowledge about various phenomena in optics interference, diffraction, polarization of light, lasers, and also covers a topic on dielectrics. It inculcates an appreciation of the physical world and the discipline of physics.

Course overview

The students acquire knowledge of the basic phenomena in optics such as Interference, diffraction and polarization. The course begins with revision of fundamentals in optics and extends into important applications. A good knowledge of optics is essential for the understanding of photonics in further. The course also covers the principle and applications of important topics such as laser, holography ,fibre optics and dielectrics.

Module I (20 hours)

Interference (12 hrs)

Interference of light - Principle of superposition - conditions for maximum and minimum intensities - coherent sources - Interference by division of wave front and division of amplitude - Young's double slit experiment (division of wave front) – Expression for fringe width - Newton's rings by reflected light (division of amplitude) - measurement of wavelength of sodium light by Newton's rings - interference in thin films.

Diffraction (8 hrs)

Introduction – Difference between Interference and diffraction - Fresnel and Fraunhofer diffraction - Fresnel Diffraction at a straight edge - Theory of plane transmission grating - Determination of wavelength (normal incidence) – resolving power - dispersive power.

Text Book: A*Text book of Optics- N. Subrahmanyam, Brijlal and M.N.Avadhanulu (S. Chand and Co.)*

Module II (10 hours)

Polarization (10 hrs)

Polarization - preferential direction in a wave - polarized light - natural light - production of linearly polarized light – polarization by reflection – Brewster's law - polarization by double refraction – calcite crystal – optic axis – principal section – positive and negative crystals – Huygen's explanation of double refraction - phase difference between O and E rays – types of polarization – retardation plates (only half wave plate and quarter wave – Nicol prism – Malus's law.

Text Book: *Modern Physics, R Murugeshan, KiruthigaSivaprasath, S. Chand and Co.*

Module III (24 hours)

Lasers (10 hours)

Interaction of light and matter - quantum behavior of light - energy levels – population - thermal equilibrium - absorption and emission of light - the three processes - Einstein relation - condition for large stimulated emissions - condition for light amplification - population inversion – pumping - active medium - metastable state - pumping schemes - solid state lasers – ruby laser &yag laser - gas laser – helium-neon laser - applications (basic ideas).

Holography (1 hour)

Holography –introduction – principle- method-advantages and applications

Text book : *An Introduction to LASER – theory and applications, M.N. Avadhanulu., S Chand & Company, First edition, Chapter 1- sections: 1.3 to 1.13-1.15 to 1.16 & 1.18 to1.20- Chapter 2- sections:2.2- 2.2.1 & 2.2.2 - 2.3 & 2.3.1. & Chapter 5.*

Fibre optics(3 hours)

Introduction-optical fibre-critical angle of propogation-acceptance angle-types of optical fibres-single mode –multimode-graded index fibre-fibre optic communication system.

Text book: Text Book: A*Text book of Optics- N. Subrahmanyam, Brijlal and M.N.Avadhanulu (S. Chand and Co.)*

Dielectrics (10 hours)

Dielectrics- polar and non-polar dielectrics- polarization- sources of polarization-Gauss's law in dielectrics- permittivity- dielectric displacement vector- dielectric constant susceptibility- ferro-electricity.

Text book *:*

1. *Electricity and Magnetism , D C Tayal*

2. *Electricity and Magnetism- J. H. Fewkes& John Yarwood*

3. *Electricity and Magnetism – R. Murugeshan*

Refererence:

1. *Introduction to Modern Physics- H.S. Mani and G.K. Mehta (Affiliated East West press Pvt. Ltd)*
2. *Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)*
3. *3. A text book of optics- N. Subrahmanyam, Brijlal and M.N.Avadhanulu (S. Chand and Co.)*
4. *Optics- Satyaprakash (RatanprakashMandir)*
5. *Modern Physics- G.Aruldas and P.Rajagopal (PHI Pub)*
6. *Optics- A. Ghatak (Tata McGraw-Hill)*

Competencies:

- Define interference of light
- State the principle of superposition
- Derive the conditions for maximum and minimum intensities
- Define coherent sources
- Discuss interference by division of wavefront and division of amplitude
- Explain Young's double slit experiment
- Calculate the expression for fringe width
- Calculate the wavelength of sodium light by Newton's rings experiment
- Discuss the interference in thin films
- Differentiate between Fresnel and Fraunhofer diffraction
- Discuss Fresnel's diffraction at a straight edge

- Determine the wavelength of light using transmission grating
- Define resolving and dispersive powers
- Identify transverse and longitudinal waves
- Define polarization of light
- Discuss polarization by reflection
- State Brewster's law
- Define optic axis, principal section, positive crystals and negative crystals
- State double refraction
- Describe Huygen's explanation of double refraction
- Discuss retardation plates
- Understand Nicol prism
- State Malus's law
- Explain the terms - Interaction of light and matter, Quantum behavior of light, Energy levels, Population and Thermal equilibrium.
- Explain Absorption and emission of light.
- Categorize absorption and emission process.
- Describe Einstein coefficients.
- Determine the relation between Einstein coefficients.
- Determine the condition for light amplification.
- Discuss population inversion.
- Define pumping and metastable state
- Describe the basic components of laser device.
- Explain different methods of pumping.
- Explain the construction and working of Ruby laser.
- Describe the working of YAG laser.
- Explain the construction and working of Helium – Neon laser.
- Explain the principle of holography.
- Identify the advantages and applications of holography.
- Explain the construction and working of an optical fibre
- What is the significance of critical angle in optical fibre.

- Differentiate single mode and multimode graded index fibres.
- Explain the application of fibre optics in communication.
- Compare polar and non-polar dielectric.
- Explain the sources of polarization.
- State Gauss 's law in dielectrics .
- Define permittivity.
- Calculate the dielectric constant susceptibility.
- Explain the concept of ferroelectricity.

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PH4C01B18 Physical Optics, Laser Physics and dielectrics

Module	**Hours** **54**	**Marks** **1** **5 / 5**	**Marks** **2** **5 / 8**	**Marks** **5** **5/8**	**Marks** **10** **2/4**	**Total** **60**
I Interference Diffraction	20	2	3	3	1	33
II Polarization	10	1	2	2	1	25
III Lasers holography Dielectric	24	2	3	3	2	43

SYLLABUS FOR COMPLEMENTARY PHYSICS FOR CHEMISTRY

Semester I

PH1C02B18: PROPERTIES OF MATTER & THERMODYNAMICS

(Complementary Course for B.Sc Chemistry)

Credits - 2

Total lecture hours - 36 hrs

Aim

This course will try to provide conceptual understanding of basic physics to students and will provide a theoretical basis for doing experiments in related areas.

Course Overview

This course exposes students to basic physics. It helps to understand basic phenomena in Physics such as Elasticity, Surface tension and hydrodynamics. The topics on thermodynamics is also a part of the syllabus and are intended to develop a basic knowledge required to design any device involving the interchange between heat and work or the conversion of material to produce heat. Module I covers elasticity. Module II is divided into hydrodynamics and surface tension. Module III handles thermodynamics.

Module I

Elasticity (13 hours)

Stress- strain- Hooke's law- Elastic moduli- Poisson's ratio- twisting couple determination of rigidity modulus- static and dynamic methods- static torsion- torsion pendulum, bending of beams- cantilever, uniform and non-uniform bending, I section girder.

Text Book :*Mechanics - D. S. Mathur- Revised by P. S. Hemne, S. Chand & Co., Chapters 13 & 14.*

Module II

Surface tension (3 hours)

Molecular theory of surface tension - surface energy - excess pressure in a liquid drop, factors affecting surface tension – applications

Text book:*Mechanics– Prof. D.S Mathur Revised by: Dr. P.S Hemne. , S Chand & Company Pvt. Ltd, chapter 15*

Hydrodynamics (7 hours)

Streamline and turbulent flow - critical velocity - Coefficient of viscosity - Derivation of Poiseuille's equation, Stokes equation-Determination of viscosity by Poiseuille's method-Brownian motion – Viscosity of gases – Bernoulli's theorem.

Text book: *Properties of Matter- Brijlal and N. Subrahmaniam, S. Chand &Company Pvt. Ltd,1989, Chapter 8*

Module III

Thermodynamics (13 hours)

Thermodynamic systems- thermodynamic equilibrium- thermodynamic processes isothermal process- adiabatic process- zeroth law of thermodynamics, first law of thermodynamics- heat engine- the Carnot engine- refrigerator, concept of entropy second law of thermodynamics- third law of thermodynamics- Maxwell's thermodynamic relations.

Text Book *: Heat and Thermodynamics, Brijlal and Subrahmanyam and P. S. Hemne, S. Chand & Co., Chapter 5 & 6*

References

1. Mechanics - H.S.Hans and S.P.Puri. (Tata McGraw-Hill)

2. Properties of Matter - Brijlal and N. Subrahmanyam (S. Chand and Co.)

3. Mechanics - J.C. Upadhyaya (Ram Prasad and sons)

4. Heat and Thermodynamics – Mark W Zemanski (Tata McGraw-Hill)

Competencies

- State Hooke's law
- Categorize different types of elasticity
- Define Poisson's ratio
- Establish the relation between volume strain and linear strain
- Define twisting couple on a cylinder, angle of twist and angle of shear
- Identify bending moment,

- Discuss the cases of bending of beams in cantilever, centrally loaded
- supported beam
- Introduce Molecular theory of surface tension and surface energy-
- Calculate excess pressure in a liquid drop or an air bubble in a liquid
- Determine the velocity of transverse waves on liquid surface
- Mention factors affecting surface tension
- Distinguish stream line and turbulent flow
- Define Critical velocity,
- State the significance of Reynold's Number
- Derive Poiseuille's equation for a liquid flowing through a narrow tube
- Illustrate the calculation of coefficient of viscosity of a viscous liquid
- Obtain Meyer's formula
- Statement of Bernoulli's theorem.
- Understand thermodynamic systems
- Explain zeroth law of thermodynamics
- Define first law of thermodynamics
- Draw indicator diagram
- Differentiate between adiabatic and isothermal processes
- Understand thermodynamic potentials
- Distinguish between reversible and irreversible processes
- Describe the working of Carnot's engine
- Define entropy
- Calculate entropy in reversible and irreversible processes
- Discuss Clapeyron's latent heat equation

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PH1C02B18: PROPERTIES OF MATTER & THERMODYNAMICS

Module	**Hours** **36**	**Marks** **1**	**Marks** **5**	**Marks** **10**	**Total** **60**
		10 / 12	**6/9**	**2/4**	**60/97**
I Elasticity	13	5	4	1	35
II Surface Tension and Hydrodynamics	10	2	3	1	27
III Thermodynamics	13	5	2	2	35

MODEL QUESTION PAPER

PH1C02B18: PROPERTIES OF MATTER & THERMODYNAMICS

Time : 3 hours Maximum Marks : 60

Part A

Very Short Answer Questions.

Answer **any ten***questions briefly. Each question carries* ***1*** *mark.*

1. State Hooke's law?
2. What are plastic bodies?
3. What is meant by flexural rigidity of a beam? Write the expression for flexural rigidity?
4. What do you mean by torsional rigidity?
5. What is Poisson's ratio?
6. State Bernoulli's theorem?
7. Define critical velocity?
8. State first law of thermodynamics.
9. During an adiabatic process, the system experiences a change in temperature. Why?
10. Define coefficient of performance of a refrigerator. Is it greater than 1?
11. Define entropy?
12. How can a state of thermodynamic equilibrium be realized by a systema?

Part B

Answer **any six** *questions. Each question carries 5 marks*

13. Two identical wires of steel and copper are stretched by the same weight in turn. Calculate the ratio of the extensions produced in the wire. Y for steel and Cu are 2 x10^{11} and 1.2 x10^{11} N/m2 respectively.
14. A cantilever shows a depression of 1cm at the loaded end. What is the depression at its midpoint?
15. A rod of width 2.5 cm and thickness 2 mm is supported symmetrically on two knife edges 1 m apart. When loaded with weight 200 g at each end which are projected 10

cm from the respective knife edges, the centre is elevated by 4 mm. What is the young's modulus of the material?

16. Calculate the force required to stretch a steel wire to double its length when its area of cross-section is 1 cm^2 and $Y=2x10^{11}$ N/m^2.
17. Calculate the work done in blowing a soap bubble of radius 10^{-2} m to a radius 10^{-1} m. Surface Tension of soap bubble is 27 $x10^{-3}$ N/m.
18. Water is conveyed through a horizontal tube 8cm in diameter and 4 km in length at a rate of 20 litre per second. Assuming only viscous resistance, calculate the pressure required to maintain this flow.
19. Calculate the mass of water flowing in 10seconds through a horizontal capillary tube of circular cross section of radius 10.3m .The tube is filled at the bottom of a constant level tank at a depth of 1m. Length of the tube is 0.3142 m.
20. The efficiency of a Carnot engine working between the temperatures is 0.2. When the temperature of the source is increased by 25^0C, the efficiency increases to 0.25. Find temperatures of the source and sink.
21. A carnot engine whose cold reservoir is at 280 K has an efficiency of 40 %. It is desired to increase the efficiency to 50 %. By how much should the temperature of the hot reservoir be raised?

Part C

Answer any **two** *questions. Each question carries 10 marks*

22. What is meant by torsional couple. Derive an expression for the couple per unit twist of a cylindrical rod.
23. Derive Poiseuille's equation for a liquid flowing through a narrow tube.
24. Derive Maxwell's thermodynamical relations.
25. Describe Carnot engine. With the help of an indicator diagram, carefully describe the various processes which make up the Carnot cycle. Derive the expression for its efficiency.

Semester II

PH2C02B18: MECHANICS AND CRYSTALLOGRAPHY

(Complementary Course for B.Sc Chemistry)

Credits - 2

Total lecture hours - 36 hrs

Aim

This course will try to provide conceptual understanding of basic mechanics and crstallography to students and will provide a theoretical basis for doing experiments in related areas.

Course Overview

This course exposes students to basic physics of rotational dynamics, oscillations and waves.. Further this course includes topic of crystallography to provide understanding about crystal systems, planes and its diffraction.

Module I

Motion under gravity (5 hours)

Velocity- acceleration- force – acceleration due to gravity - compound pendulum (symmetric and asymmetric) radius of gyration –centripetal acceleration and force - centrifugal force

Textbook:

Elements of properties of matter, D S Mathur- S Chand, chapter 6

Rotational dynamics (10 hours)

Angular velocity- angular momentum- torque- conservation of angular momentum angular acceleration- moment of inertia- parallel and perpendicular axes theorems moment of inertia of rod, ring, disc, cylinder and sphere- flywheel

Textbook:

Mechanics- D S Mathur,(revised edition 2012), Chapter 11

Module II

Oscillations (9 hours)

Periodic and oscillatory motion- simple harmonic motion- differential equation, expression for displacement, velocity and acceleration- graphical representation- energy of a particle executing simple harmonic motion damped oscillation- forced oscillation and resonance.

Textbook: *Mechanics- D S Mathur,(revised edition 2012), Chapter 7,8.*

Waves (4 hours)

Waves-classifications- progressive wave- energy of progressive wave- superposition of waves-theory of beats- Doppler effect.

Textbook: *Mechanics- D S Mathur,(revised edition 2012), Chapter 10*

Module III

Crystalline Solids (8 hrs)

Crystalline and amorphous solids – crystal lattice and translation vectors – basis– unit cell – lattice parameters – crystal systems – crystal planes and directions –Miller indices – inter planar spacing – hcp, fcc, bcc, sc crystal structures –Bragg's law of X ray diffraction.

Textbook: *Solid State Physics- R.K.Puri and V.K.Babbar, S.Chand& Co.*

References

1. *Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)*
2. *A text book on oscillations waves and acoustics, M.Ghosh , D Bhattacharya*
3. *Solid State Physics- R. K. Puri and V.K. Babbar (S. Chand and Co.)*
4. *Elementary Solid State Physics,Ali Omar*
5. *Modern Physics- Murugeshan- S Chand*

Competencies

- Give the idea of acceleration due to gravity.
- Discuss about symmetric and asymmetric compound pendulum.
- Define radius of gyration.
- Introduce centripetal acceleration.
- Distinguish between centripetal and centrifugal force.

- Describe torque.
- Describe angular momentum.
- Describe angular impulse.
- Describe moment of inertia.
- Describe radius of gyration.
- Determine the relationship between torque and angular momentum.
- Determine the relationship between torque and moment of inertia.
- Determine the relationship between torque and angular acceleration.
- State and prove parallel and perpendicular axes theorems
- Determine the moment of inertia of following shapes, (i)Uniform Rod (ii) Rectangular lamina (iii) thin circular ring (iv) circular disc (v) annularring (vi) solid cylinder (vii) hollow cylinder (viii)Spherical shell, sphereand hollow sphere.
- Describe flywheel.
- Design an experiment to determine moment of inertia of flywheel
- Define Simple Harmonic Motion with examples
- Set up differential equation of Simple Harmonic Motion
- Describe velocity and acceleration of harmonic oscillator
- Recognize the phase relationship between displacement, velocity and
- acceleration of harmonic oscillator
- Explain the Potential, Kinetic and total energies of harmonic oscillator
- Draw the variations of Potential, Kinetic and total energies withamplitude.
- Classify different types of harmonic oscillator.
- Set up and solve the differential equation of damped harmonic oscillator
- Illustrate overdamped, underdamped and critically damped cases
- Set up and solve the differential equation of forced harmonic oscillator.
- Describe amplitude and velocity resonance.
- Describe sharpness of resonance.
- Classify types of waves
- Recognize wavelength, frequency and wave number
- Obtain the equation for a plane progressive harmonic wave
- Explain distribution of energy in a plane progressive wave

- Extend the theory beats to concerned problems
- State Doppler effect
- Differentiate between crystals and amorphous solids
- Identify lattice and basis
- Explain lattice translation vectors
- Define unit cell
- List crystal systems
- Calculate Miller indices
- Relate between inter planar spacing and Miller indices
- Discuss hcp, fcc, bcc and sc crystal structures
- Define Bragg's law

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PH2C02B18: MECHANICS AND CRYSTALLOGRAPHY

Module	**Hours** **36**	**Marks** **1**	**Marks** **5**	**Marks** **10**	**Total** **60**
		10 / 12	**6/9**	**2/4**	
I Motion under gravity and Rotational dynamics	15	5	3	2	40
II Oscillations and waves	13	5	4	1	35
III Crystalline solids	8	2	2	1	22

Semester III

PH3C02B18 - MODERN PHYSICS AND BASIC ELECTRONICS

(Complementary Course for B.Sc. Chemistry)

Credits: 3

Total lecture hours - 54 hrs

Aim

The aim of the course is to make the students aware of the basic principles of latest emerging technologies. Electronics industry is an evolving field based upon the advancements in the Semiconductor Physics. Spectroscopy and Radioactivity are another major fields to obtain finer details of the materials.

Course Overview:

The first module of the course introduces the students to basic structure of matter and its interaction with radiation. It also gives an introductory idea about Quantum Mechanics and the basics of semiconductor physics. The course also covers features of nucleus such as radioactivity and nuclear fusion – fission reactions.

Module I (16hrs)

Atom models and Spectroscopy (16hrs)

Thomson's model - Rutherford's nuclear atom model (qualitative) - Bohr atom model – Bohr radius – total energy of the electron – Bohr's interpretation of Hydrogen atom- Sommerfeld's relativistic atom model – elliptical orbits of Hydrogen (qualitative) – Sommerfeld's relativistic theory – fine structure of Hα line - Vector atom model – quantum numbers associated with vector atom model – coupling scheme (qualitative) - optical spectra – spectral terms – spectral notation – selection rules.

Molecular spectra – theory of origin of pure rotational spectra of rigid diatomic molecule - Raman effect – experimental study of Raman effect – quantum theory of Raman effect-- fluorescence and phosphorescence.

Text Book: *Modern Physics, R. Murugeshan, S. Chand and Co., Chapter 6,19.*

Module II (12 hours)

Quantum Mechanics (12 hrs)

Introduction – breakdown of classical physics – black body radiation and Planck's quantum hypothesis (qualitative) – photoelectric effect – Einstein's explanation of photoelectric effect – de Broglie hypothesis – matter wave – Davisson Germer experiment – uncertainty principle (derivation and application not required) - wave packet – wave function – properties of wave function – probabilistic interpretation of wave function – normalisation condition – time independent Schrödinger equation – particle in a box problem.

Text Books:

1. *Modern Physics, G. Aruldhas and P. Rajagopal, Tata McGraw-Hill, 5thedn.*
2. *Quantum Mechanics, Aruldhas, PHI Pub.*
3. *Modern Physics , Arthur Beiser, Tata McGraw-Hill*

Module III (11 hours)

Basic Electronics (11 hrs)

Energy bands in solids - conduction in solids – semiconductors - majority and minority charge carriers - intrinsic conduction. PN junction diodes – biasing - diode equation (derivation not required), diode parameters, diode ratings - diode characteristics - junction break down. Rectifiers - half wave, full wave and bridge rectifiers. Zener diode characteristics – voltage regulation. Bipolar junction transistors – biasing - transistor currents - transistor circuit configurations - common emitter configurations.

Text Book: *Basic Electronics , B. L. Theraja - Chapter12 (12.17, 12.20, 12.22, 12.23-26, 12.30), Chapter 13, Chapter14, Chapter15(15.1-2), Chapter 18(18.1- 18.8).*

Module IV (15 hours)

Nuclear Physics (8hrs)

Classification of nuclei - general properties of nucleus - binding energy - nuclear stability - theories of nuclear composition - nuclear forces - magic numbers - natural radioactivity - alpha- beta & gamma rays - properties of alpha rays - properties of beta rays - properties of

gamma rays- fundamental laws of radioactivity – Soddy Fajan's displacement law - law of radioactive disintegration – half life - mean life - units of radioactivity - law of successive disintegration - radioactive dating.

Text Book: *Modern Physics , R Murugeshan, KiruthigaSivaprasath, S. Chand and Co., Chapter 27- sections:27.1 to 27.7 & 27.10, Chapter 31- sections:31.1 to 31.5, 31.29 to 31.31 & 31.33 to 31.35.*

Nuclear Fission & Fusion (7 hrs)

Nuclear fission- Energy released in fission- Chain reaction- Atom bomb- Nuclear reactors - Nuclear Fusion- Source of stellar energy- Thermonuclear reactions- Transuranic elements.

Text book:

Modern Physics, R Murugeshan- KiruthigaSivaprasath, S Chand & Co. , Chapter 35

References:

1. *Concepts of Modern Physics- A. Beiser , Tata McGraw-Hill, 5th Edn.*
2. *Modern Physics, G. Aruldas and P.Rajagopal , PHI Pub.*
3. *Quantum Physics- S. Gasiorowicz (John Wiley & Sons)*
4. *Introduction to Modern Physics- H.S. Mani and G.K. Mehta*

Competencies:

- Discuss Thomson's and Rutherford's atom models.
- Discuss the Bohr's atom model.
- Calculate the Bohr radius and total energy of an electron.
- Explain Bohr's interpretation of Hydrogen atom.
- Discuss Sommerfeld's atom model.
- Discuss vector atom model.
- Explain quantum numbers in vector atom model.
- Understand the coupling schemes and selection rules.
- Understand the molecular spectra.
- Explain the Raman effect and illustrate quantum theory to explain the effect.

- Understand the inefficiency of classical mechanics.
- Explain black body radiation.
- State Planck's quantum hypothesis of black body radiation.
- Define photoelectric effect.
- Discuss Einstein's explanation of black body radiation.
- Define de Broglie hypothesis.
- Define uncertainty principle.
- Discuss Davisson Germer experiment.
- Define wavefunction.
- List the properties of wavefunction.
- Explain time independent Schrodinger equation.
- Discuss particle in a box problem.
- Understand the conduction in solids
- Discuss p-n junction diode
- Explain diode characteristics
- Discuss rectification process
- Understand the working of Zener as a voltage regulator
- Define thermal run away
- Relate α, β and γ
- Explain different types of transistor configurations
- Mention different types of nuclei.
- Describe the properties of nucleus.
- Explain Binding energy.
- Calculate binding energy of nucleus.
- Describe Nuclear stability.
- State electron- proton hypothesis.
- State proton- neutron hypothesis.
- Describe nuclear force.
- Mention the features of nuclear force.
- List magic numbers.

- Explain natural radioactivity.
- Describe the experimental set up.
- Focus and distinguish between Properties of Alpha, Beta & Gamma rays.
- State Soddy Fajan's displacement law.
- State law of radioactive disintegration.
- Determine the mean life of radioactive material.
- Define Units of radioactivity- Curie & Rutherford.
- Determine the age of earth.
- Determine the age of biological specimen – carbon dating.
- Define Q value.
- Calculate threshold energy of an endoergic reaction.Describe Nuclear fission with examples.
- Calculate the energy released in a fission.
- Determine the energy released by 1Kg of uranium in fission. and express
- the answer in Kilowatt- hour.
- Discuss Bohr and Wheeler's theory of nuclear fission.
- Describe chain reaction with example.
- Define multiplication factor and categorize chain reaction.
- Discuss critical size for maintenance of chain reaction.
- Describe the working of atom bomb.
- Explain the components and working of nuclear reactor.
- Mention the uses of nuclear reactor.
- Describe Nuclear fusion with examples.
- Calculate the energy released in a fission.
- Discuss the source of stellar energy.
- Describe carbon – nitrogen and proton- proton Cycles.
- Discuss thermonuclear reaction.
- Describe hydrogen bomb and controlled thermonuclear reactions.
- List transuranic elements.

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PH3C02B18 - MODERN PHYSICS AND BASIC ELECTRONICS

Module	**Hours**	**Marks 1** **10 / 12**	**Marks 5** **6/9**	**Marks 10** **2/4**	**Total 60**
I Atom models Spectroscopy	16	4	3	1	29
II Quantum Mechanics	12	1	2	1	21
III Basic Electronics	11	5	1	1	20
III Nuclear Physics Nuclear Fission & Fusion	15	2	3	1	27

Semester: IV

PH4C02B18 : Physical Optics , Laser Physics and Superconductivity

(Complementary Course for B.Sc Chemistry)

Credits: 3

Total lecture Hours: 54

Aim

The syllabus will cater to the basic requirements for his/her higher studies. It is expected to provide the learner the knowledge about interference, diffraction, polarization of light, lasers, and superconductivity. It inculcates an appreciation of the physical world and the discipline of physics.

Course overview

The students acquire knowledge of the basic phenomena in optics such as Interference, diffraction and polarization. The course begins with revision of fundamentals in optics and extends into important applications. A good knowledge of optics is essential for the understanding of photonics in further. The course also covers the principle and applications of important topics such as laser, holography and superconductivity.

Module I (20 hours)

Interference (12 hrs)

Interference of light - Principle of superposition - conditions for maximum and minimum intensities - coherent sources - Interference by division of wave front and division of amplitude - Young's double slit experiment (division of wave front) – Expression for fringe width - Newton's rings by reflected light (division of amplitude) - measurement of wavelength of sodium light by Newton's rings - interference in thin films.

Diffraction (8 hrs)

Introduction – Difference between Interference and diffraction - Fresnel and Fraunhofer diffraction - Fresnel Diffraction at a straight edge - Theory of plane transmission grating - Determination of wavelength (normal incidence) – resolving power - dispersive power.

Text Book: A*Text book of Optics- N. Subrahmanyam, Brijlal and M.N.Avadhanulu (S. Chand and Co.)*

Module II (12 hrs)

Polarization (12 hrs)

Polarization - preferential direction in a wave - polarized light - natural light - production of linearly polarized light – polarization by reflection – Brewster's law - polarization by double refraction – calcite crystal – optic axis – principal section – positive and negative crystals – Huygen's explanation of double refraction - phase difference between O and E rays – types of polarization – retardation plates – Nicol prism – Malus's law.

Text Book: *Modern Physics, R Murugeshan, KiruthigaSivaprasath, S. Chand and Co.*

Module III (22 hrs)

Lasers (10 hours)

Interaction of light and matter - quantum behavior of light - energy levels – population - thermal equilibrium - absorption and emission of light - the three processes - Einstein relation - condition for large stimulated emissions - condition for light amplification - population inversion – pumping - active medium - metastable state - pumping schemes - solid state lasers – ruby laser &yag laser - gas laser – helium-neon laser - applications (basic ideas).

Holography (2 hours)

Holography –introduction – principle- method-advantages and applications

Text book : *An Introduction to LASER – theory and applications, M.N. Avadhanulu., S Chand & Company, First edition, Chapter 1- sections: 1.3 to 1.13-1.15 to 1.16 & 1.18 to1.20- Chapter 2- sections:2.2- 2.2.1 & 2.2.2 - 2.3 & 2.3.1. & Chapter 5.*

Fibre optics(5 hours)

Introduction-optical fibre-critical angle of propogation-acceptance angle-types of optical fibres-single mode –multimode-graded index fibre-fibre optic communication system.

Text book: Text Book: A*Text book of Optics- N. Subrahmanyam, Brijlal and M.N.Avadhanulu (S. Chand and Co.)*

Superconductivity (5 hours)

Super conducting phenomenon- Occurrence- BCS theory (qualitative) Meissner Effect- Type I and Type II superconductors- Josephson effects (qualitative) - High temperature superconductors- Applications of Superconductivity

Text book: *Modern Physics – R Murugeshan- KiruthigaSivaprasath, S Chand & Company, Chapter 41- Sections: 41.13-41-14 & 41.15- Chapter 42- Sections: 42.1 & 42.2 & Chapter 44 - Sections: 44.1- 44.5 &44.6*

Refererence:

1. Introduction to Modern Physics- H.S. Mani and G.K. Mehta (Affiliated East West press Pvt. Ltd)

2. Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)

3. A text book of optics- N. Subrahmanyam, Brijlal and M.N.Avadhanulu (S. Chand and Co.)

4. Optics- Satyaprakash (RatanprakashMandir)

5. Modern Physics- G.Aruldas and P.Rajagopal (PHI Pub)

6. Optics- A. Ghatak (Tata McGraw-Hill)

Competencies:

- Define interference of light
- State the principle of superposition
- Derive the conditions for maximum and minimum intensities
- Define coherent sources
- Discuss interference by division of wavefront and division of amplitude
- Explain Young's double slit experiment
- Calculate the expression for fringe width
- Calculate the wavelength of sodium light by Newton's rings experiment
- Discuss the interference in thin films
- Differentiate between Fresnel and Fraunhofer diffraction

- Discuss Fresnel's diffraction at a straight edge
- Determine the wavelength of light using transmission grating
- Define resolving and dispersive powers
- Identify transverse and longitudinal waves
- Define polarization of light
- Discuss polarization by reflection
- State Brewster's law
- Define optic axis, principal section, positive crystals and negative crystals
- State double refraction
- Describe Huygen's explanation of double refraction
- Discuss retardation plates
- Understand Nicol prism
- State Malus's law
- Explain the terms - Interaction of light and matter, Quantum behavior of light, Energy levels, Population and Thermal equilibrium.
- Explain Absorption and emission of light.
- Categorize absorption and emission process.
- Describe Einstein coefficients.
- Determine the relation between Einstein coefficients.
- Determine the condition for light amplification.
- Discuss population inversion.
- Define pumping.
- Define metastable state
- Describe the basic components of laser device.
- Explain different methods of pumping.
- Explain the construction and working of Ruby laser.
- Describe the working of YAG laser.
- Explain the principle of holography.
- Identify the advantages and applications of holography.
- Explain the construction and working of an optical fibre

- What is the significance of critical angle in optical fibre.
- Differentiate single mode and multimode graded index fibres.
- Explain the application of fibre optics in communication
- Describe Superconductivity.
- Define persistent current.
- Explain critical magnetic field.
- Write down the formula relating the temperature and critical magnetic field
- Explain Meissner effect
- Recognize that superconductors are diamagnetic materials.
- Explain BCS theory.
- Classify superconductors.
- Discuss magnetic levitation.
- Explain ac and dc Josephson effect.
- Mention high Tc superconductivity.
- List applications of superconductivity.

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PH4C02B18 : Physical Optics, Laser Physics & Superconductivity

Module	**Hours**	**Marks**	**Marks**	**Marks**	**Marks**	**Total**
	54	**1**	**2**	**5**	**10**	**60**
		5 / 5	**5 / 8**	**5/8**	**2/4**	
I Interference,	20	1	2	2	2	35
II Polarisation	12	3	2	3	1	32
III Laser, Holography	22	1	4	3	1	34

SYLLABUS FOR PRACTICAL

COMPLEMENTARY PHYSICS FOR MATHEMATICS AND CHEMISTRY

Practical (1st Year)

Codes: PH2CP01B18 (for Mathematics)**& PH2CP02B18** (for Chemistry)

Credit: 2

No. of hours: 72

1. Vernier Calipers - Volume of a cylinder- sphere and a beaker
2. Screw gauge - Volume of a sphere and a glass plate
3. Beam balance - Mass of a solid (sensibility method)
4. Radius of a capillary tube- Using (1) travelling microscope
5. Density of a liquid - U-Tube and Hare's apparatus
6. Viscosity of a liquid - Variable pressure head
7. Surface Tension – Capillary rise method.
8. Cantilever - Pin & Microscope – Determination of Young's Modulus
9. Symmetric Compound Pendulum-Determination of radius of gyration(K) and Acceleration due to gravity (g)
10. Spectrometer – Angle of the Prism.
11. Cantilever – Scale and Telescope-Determination of Young's modulus
12. Asymmetric Compound Pendulum-Determination of K and g
13. Coefficient of Viscosity – Constant pressure head
14. Spectrometer - Refractive Index of material of prism.
15. Liquid lens - Refractive Index of glass using liquid of known refractive index
16. Potentiometer-Calibration of low range voltmeter
17. Characteristics of Zener diode
18. Construction of half wave rectifier with and without filter – Ripple factor and Load regulation
19. Characteristics of p-n junction diode
20. Torsion pendulum - Rigidity modulus

Practical (2nd Year)

Codes: PH4CP01B18 (for Mathematics)**& PH4CP02B18** (for Chemistry)

Credit: 2

No. of hours: 72

1. Non-uniform bending-Young's modulus-Pin and Microscope method
2. Field along the axis of circular coil- Variation of magnetic field and determination of B_H
3. Carey Foster's Bridge - Measurement of resistivity
4. Liquid lens - Refractive index of liquid
5. Searle's vibration Magnetometer-magnetic moment
6. Tangent Galvanometer – Ammeter calibration
7. Spectrometer – Prism – Dispersive power
8. Potentiometer-Calibration of low range ammeter
9. Construction of full wave rectifier with and without filter – Ripple factor and Load regulation
10. Construction of regulated power supply using Zener diode
11. Uniform bending – Young's modulus-Optic lever method
12. Torsion pendulum (Equal mass method) - Rigidity modulus and Moment of Inertia
13. Fly wheel - Moment of Inertia
14. Static Torsion - Rigidity modulus
15. Spectrometer - Grating Dispersive power
16. Newton's rings - Wave length
17. Deflection and Vibration Magnetometer- m & Bh
18. Conversion of Galvanometer into voltmeter
19. Transistor characteristics- CE configuration
20. Gates – AND - OR- NOT- verification of truth table
21. Construction of CE amplifier – gain

References

1. Properties of matter - D.S. Mathur
2. Optics - Subrahmanyan & Brijlal
3. Electricity &Magnetism - Sreevastava
4. Electronics Lab Manual (Vol.1) - K.A.Navas
5. Laboratory manual for electronic devices and circuits- David A Bell
6. Electronic Laboratory Primer- A design approach- S Poorna Chandra and B Sasikala.
7. A text book of Practical Physics _ Indu Prakash and Ramakrishnan.