ASSUMPTION COLLEGE
AUTONOMOUS
CHANGANACHERRY

Reaccredited by NAAC with 'A' Grade
Affiliated to Mahatma Gandhi University
Kottayam

CURRICULUM FOR UNDER GRADUATE PROGRAMME
IN
PHYSICS

Under Choice Based Credit System (CBCS)

(2017 Admission onwards)

BOARD OF STUDIES IN PHYSICS (Combined UG & PG)

1.	Dr Regimol C Cherian, Associate Professor PG Department of Physics, Assumption College Autonomous	**Chairperson**
2.	Dr Manoj Raama Varma, Senior Principal Scientist NIIST, Thiruvananthapuram	**Subject Expert**
3.	Mr Santhosh Kumar R, Assistant Professor PG Department of Physics, St. George College, Aruvithura	**Subject Expert**
4.	Dr Biju V, Head of the Department Department of Physics, University of Kerala Thiruvananthapuram	**Member**
5.	Dr Noble P Abraham, Assistant Professor PG Department of Physics, Mar Thoma College Thiruvalla	**Member**
6.	Dr K Rajeev, Scientist SG, Space Physics Laboratory VSSC, Thiruvananthapuram	**Industry Representative**
7.	Ms Bridgit Joe, Senior Architect WIPRO Technologies, Infopark, Kochi	**Industry Representative**
8.	Ms Rani George, Assistant Professor PG Department of Physics, St. Aloysius College, Edathua	**Alumna**
9.	Ms Lilly Joseph, HOD, Associate Professor PG Department of Physics Assumption College Autonomous	**Member**
10.	Dr Marina Aloysius, Assistant Professor PG Department of Physics Assumption College Autonomous	**Member**
11.	Dr Sherin Thomas, Assistant Professor PG Department of Physics Assumption College Autonomous	**Member**

12. Dr Jesly Jacob, Assistant Professor
    PG Department of Physics
    Assumption College Autonomous **Member**

FACULTY MEMBERS WHO HAVE CONTRIBUTED TOWARDS CURRICULUM AND SYLLABI
[other than BoS members]

Ms. Joli Joseph, Assistant Professor, PG Department of Physics, Assumption College Autonomous, Changanacherry.

Ms. Joselin Xavier, Assistant Professor, PG Department of Physics, Assumption College Autonomous, Changanacherry.

Dr. Vidhu V K, FIP Substitute, PG Department of Physics, Assumption College Autonomous, Changanacherry.

Ms. Divya Joseph, Assistant Professor on contract, PG Department of Physics, Assumption College Autonomous, Changanacherry.

Ms. Neethu Anu Mathew, Assistant Professor on contract, PG Department of Physics, Assumption College Autonomous, Changanacherry.

Ms. Achamma Mathew Malayil, Assistant Professor on contract, PG Department of Physics, Assumption College Autonomous, Changanacherry.

MINUTES OF MEETING OF THE BOARD OF STUDIES IN PHYSICS (COMBINED UG & PG) HELD ON 21ST DECEMBER, 2016, 10:30 AM AT MINI CONFERENCE HALL, ASSUMPTION COLLEGE AUTONOMOUS, CHANGANACHERRY

The following members were present:

1. Dr Regimol C Cherian, Chairperson Sd/-
2. Ms Lilly Joseph, Member Sd/-
3. Dr Marina Aloysius, Member Sd/-
4. Dr Sherin Thomas, Member Sd/-
5. Dr Jesly Jacob, Member Sd/-
6. Dr Biju V, Member Sd/-
7. Dr Noble P Abraham, Member Sd/-
8. Ms Rani George, Member Sd/-

Agenda

1. Discussion on the draft syllabus of UG &PG Programmes for 2017-18.

2. Preparation of the Board of Examiners (Theory & Practical) for Second Semester UG&PG Examination 2016 – 17.

3. Other items permitted by the chair.

Decisions taken

1. The BoS approved the minutes of the previous meeting held on 30th May, 2016.

2. The chairperson presented the draft syllabus of both the UG and PG programmes. The members had given their suggestions. After detailed discussions the draft syllabus was finalised and forwarded to the Academic Council, for approval.

3. BoS suggested the panel of Examiners for II Sem UG (Core and Complementary) and PG programmes and forwarded to the Academic Council for approval.

4. BoS decided to insist students to use modern tools of teaching such as virtual tools, software packages etc.

5. BoS decided to conduct enrichment module 'Physics in Everyday Life' as 3 weeks workshop to create awareness on the role of Physics in everyday life for the students of Assumption College.

The meeting ended at 5:45 pm.

Read and Confirmed

Dr Regimol C Cherian
Chairperson

Dr Sr Marykutty Joseph
Principal

ACKNOWLEDGEMENT

We thank God, the Almighty, for His showers of blessings in the successful completion of the syllabus for Undergraduate Programme in Physics (2017 admission onwards).

The board of studies in Physics expresses our deepest gratitude to the patron ***His Grace Mar Joseph Perumthottam, Arch Bishop of Changanacherry*** *for the moral support and encouragement.*

We place our special gratitude to ***Rev. Dr. James Palackal****, our manager for stimulating suggestions and encouragement and also for sharing his vision of Higher Education.*

We put on record our sincere thanks to the ***Honorable Vice Chancellor, Pro Vice Chancellor, Registrar, the members of the syndicate and all the academic bodies of Mahatma Gandhi University****, for the guidance and help extended towards the College.*

We acknowledge with much appreciation ***Rev. Dr. Amala SH, Principal,*** *Assumption College for her imparted enthusiasm and willingness to support in all the junctures of our venture.*

We wish to express our sincere thanks to ***all the board of studies members*** *for their help and expert guidance rendered by them to restructure the syllabus. We are indebted to all the* ***subject experts*** *for their helpful comments & suggestions.*

Our heartfelt gratitude towards the ***Governing Council and Academic Council*** *for their support and motivation in this regard.*

I would like to express my special gratitude to ***Core Committee*** *of the College who worked dedicatedly behind this syllabus revision*

The Board of studies acknowledges the contribution of the ***faculty members of the department*** *for their contribution towards the curriculum and syllabus restructuring.*

Dr Regimol C Cherian
Chairperson, Board of Studies

Assumption College
Autonomous

AIMS AND OBJECTIVES OF THE PROGRAMME

Aims:

The Board of Studies in Physics (UG) recognizes that curriculum, course content and assessment of scholastic achievement play complementary roles in shaping education. The committee is of the view that assessment should 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. This should also support the ability to ask physical questions and to obtain solutions to physical questions by use of qualitative and quantitative reasoning and by experimental investigation. The important student attributes including appreciation of the physical world and the discipline of Physics, curiosity, creativity and reasoned skepticism and understanding links of Physics to other disciplines and to societal issues should gave encouragement. 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. The programme also aims to develop the following abilities:

1. Read, understand and interpret physical information – verbal, mathematical and graphical.
2. Impart skills required to gather information from resources and use them.
3. To give need based education in physics of the highest quality at the undergraduate level.
4. Offer courses to the choice of the students.
5. Perform experiments and interpret the results of observation, including making an assessment of experimental uncertainties.
6. Provide an intellectually stimulating environment to develop skills and enthusiasms of students to the best of their potential.
7. Use Information Communication Technology to gather knowledge at will.

8. Attract outstanding students from all backgrounds.

Objectives:

The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of Physics by providing a more complete and logical framework in almost all areas of basic Physics.

By the end of the first year (2nd semester), the students should have attained a common level in Basic Mechanics, a secure foundation in Mathematics, Chemistry, Languages and other relevant subjects to complement the core for their future courses and developed their experimental and data analysis skills through experiments at laboratories.

By the end of the fourth semester, the students should have been introduced to powerful tools for tackling a wide range of topics in Electromagnetism and Basic Electronics Semiconductor devices and circuits. Along with Languages, they should have been familiar with additional relevant techniques in Mathematics, Chemistry and developed their experimental and data analysis skills through a wide range of experiments through practical at laboratories.

By the end of the sixth semester, the students should have developed their understanding of core Physics by covering a range of topics in almost all areas of physics including Quantum Mechanics, Optics, Relativity and Spectroscopy, Thermodynamics and Basic Statistical Physics, Nuclear Physics and Particle physics, Solid State Physics, Digital Electronics and Microprocessor etc. along with open course and choice based course and had experience of independent work such as projects; seminars etc. and thereby developing their experimental skills through a series of experiments which also illustrate major themes of the lecture courses.

REGULATIONS FOR UNDERGRADUATE PROGRAMMES UNDER CBCS 2016

1. **TITLE**

   These regulations shall be called "**Regulations for Under Graduate Programmes under Choice Based Credit System, 2016**", Assumption College Autonomous.

2. **SCOPE**

   Applicable to all regular and self-financing Under Graduate Programmes conducted by the College with effect from 2017 admissions.

3. **DEFINITIONS**

   3.1. ***'Academic Week'*** is a unit of five working days in which distribution of work is organized from day-one to day-five, with five contact hours of one hour duration on each day. A sequence of 18 such academic weeks constitutes a semester.

   3.2. ***'College Co-ordinator'*** is a teacher nominated by the College Council to co-ordinate the continuous evaluation undertaken by various departments within the college. She shall be nominated by the College Principal.

   3.3. ***'Common Course I'*** means a course that comes under the category of courses for English and ***'Common Course II'*** means additional language, a selection of both is compulsory for Model I and Model II undergraduate programmes.

   3.4. ***'Complementary Course'*** means a course which would enrich the study of core courses.

   3.5. ***'Core course'*** means a course in the subject of specialization within a degree programme.

   3.6. ***'Course'*** means Paper(s) which will be taught and evaluated within a semester.

   3.7. *'**Credit'*** is the numerical value assigned to a paper according to the relative importance of the content of the syllabus of the programme**.**

   3.8. ***'Department'*** means any teaching department in a college.

3.9. ***'Department Co-ordinator'*** is a teacher nominated by the Head of Department to co-ordinate the continuous evaluation undertaken in that department.

3.10. '***Extra Credits'*** are additional credits awarded to a student over and above the minimum credits required for a programme for achievements in co-curricular activities carried out outside the regular class hours as directed by the college.

3.11. ***Grace Marks*** shall be awarded to candidates as per the Orders issued from time to time**.**

3.12. ***'Grade'*** means a letter symbol (e.g., A, B, C, etc.), which indicates the broad level of performance of a student in a course/ semester/programme.

3.13. ***'Grade point'*** (GP) is the numerical indicator of the percentage of marks awarded to a student in a course.

3.14. ***'Institutional Average (IA)'*** means average mark secured (Internal + External) for a paper at the College level.

3.15. ***'Open course'*** means a course outside the field of specialization of a student and offered by the Departments which can be opted by a student.

3.16. '***Parent Department'*** means the department which offers core courses in an under graduate programme.

3.17. ***'Programme'*** means a three year programme of study and examinations spread over six semesters, according to the regulations of the respective programme, the successful completion of which would lead to the award of a degree.

3.18. ***'Semester'*** means a term consisting of a minimum of **450** contact hours distributed over **90** working days, inclusive of examination days, within **18** five-day academic weeks.

3.19. Words and expressions used and not defined in this regulation shall have the same meaning assigned to them in the Act and Statutes of the University.

4. ELIGIBILITY FOR ADMISSION AND RESERVATION OF SEATS

4.1 Eligibility of admission, Norms for admission, reservation of seats for various Under Graduate Programmes shall be according to the rules framed by the University in this regard from time to time.

4.2 Students can opt for any one (other than core and complementary subjects) of the Open course offered by different departments of the college in the fifth semester (subject to the availability of vacancy in the concerned discipline). Selection of students in the open course will be done in the college, based on the interest of the students.

5. DURATION

5.1 The duration of U.G. programmes shall be ***6 semesters.***

5.2 There shall be two semesters in an academic year. The duration of odd semesters shall be from **June to October** and that of even semesters from **November to March.** There shall be three days semester break after odd semesters and two months vacation during April and May in every academic year.

5.3 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.

6. REGISTRATION

6.1 The strength of students for each course shall remain as per existing regulations, as approved by the University except in case of open courses for which there shall be a minimum of 15 and maximum of sanctioned strength including marginal increase.

6.2 The number of courses/credits that a student can take in a semester is governed by the provisions in these regulations pertaining to the minimum and maximum number of credits permitted.

6.3 Those students who possess the required minimum attendance and progress during an academic year/semester and could not register for the

annual/semester examination are permitted to apply for Notional Registration to the examinations concerned enabling them to get promoted to the next class.

7. SCHEME AND SYLLABUS

7.1. The U.G. programmes shall include (a) Common courses I & II, (b) Core courses, (c) Complementary Courses, (d) Open Course.

7.2. There shall be one Open course in the fifth semester.

7.3. There shall be one Choice based paper in the sixth semester with a choice of one out of three elective papers.

7.4. A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 40% are required for a pass for a paper. For a pass in a programme, a separate minimum of Grade D is required for all the individual papers. If a candidate secures F Grade for any one of the paper offered 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.

7.5. Students discontinued from previous regulations, can pursue their studies in **Regulations for Under Graduate Programmes under Choice Based Credit System, 2016**" after obtaining readmission. These students have to complete the programme as per **Regulations for Under Graduate Programmes under Choice Based Credit System**".

8. COURSE DESIGN - B Sc. PROGRAMMES IN PHYSICS

The U.G. programme in Physics must include (a) Common courses, (b) Core courses, (c) Complementary courses, (d) Choice based course (e) Open course and (f) Project. No course shall carry more than 4 credits. The student shall select any one Open course in Semester 5 offered by the Departments which offers the core courses or Physical Education department, depending on the availability of infrastructure facilities, in the institution. The number of Courses for the restructured programme should contain 12 compulsory Core Courses, 1 Open course, 1 Choice based course from the frontier area of the core courses, 6 Core practicals, 1 Project in the area of core, 8 Complementary courses, 2 Complementary practicals otherwise specified, from the relevant subjects for

complementing the core of study. There should be 10 Common Courses, or otherwise specified, which includes the first and second language of study.

8.1 PROGRAMME STRUCTURE

Model I BA/BSc

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 + complementary including Project	79
f	Credits required from Open course	3
g	Minimum attendance required	75%

8.2 SCHEME OF COURSES:

The different types of courses and its number for Model I Physics are as follows:

COURSES	NUMBER
Common Courses	10
Core Courses	12
Core Practicals	6
Open Course	1
Choice based Course	1
Project	1
Complementary Courses	8
Complementary Practicals	2
Total	41

8.3 COURSE CODE:

Every course is coded using an eight digit alpha numeric code that gives a brief description on the following details.

A. Subject Code (2 characters)

Composed of two characters, which gives a meaningful abbreviation of the subject to which the paper belongs to. The abbreviations used here are PH – Physics.

B. Semester to which course belongs to (1 digit)

Composed of single digit number which indicates the semester to which the paper belongs to (1to 6). In case of Practicals the number indicates the semester in which the exam in conducted.

C. Course type as per syllabus (2 characters)

Composed of two characters which gives meaningful abbreviation of type of the course. The abbreviations used here are CM – Complementary Course, CB – Choice Based Core, CR – Core Course, OC – Open course, PR – Project.

D. Whether 'Theory' or 'Practical' or 'Other' (1 character)

Letter 'T' is used to denote Theory papers, the letter 'P' for Practical papers.

E. Serial number of the course in continuous series (2 digits)

Composed of two digits to indicate the paper's relative position in the programme.

Eg. 01 indicates 1st paper, 05 indicates 5th paper, etc.

Sample Course Code

The Course code "PH1CRT01" indicates that the paper is

"Physics – 1st Semester – Core Course – Theory – 1st paper"

9. EXAMINATIONS

9.1 The evaluation of each course shall contain two parts:

(i) Internal or In-Semester Assessment (ISA)

(ii) External or End-Semester Assessment (ESA)

9.2 The internal to external assessment ratio shall be 1:4, for both courses with or without practical. There shall be a maximum of 80 marks for external evaluation and maximum of 20 marks for internal evaluation. For all courses (theory & practical), grades are given on a 7-point scale based on the total percentage of marks. *(ISA+ESA)* as given below:

Percentage of Marks	Grade	Grade Point
95 and above	O - Outstanding	10
85 to below 95	A+ - Excellent	9
75 to below 85	A - Very Good	8
65 to below 75	B+ - Good	7
55 to below 65	B - Above average	6

50 to below 55	C - Average	5
40 to below 50	D - Pass	4
Below 40	F - Fail	0
	Ab - Absent	0

Note: Decimal are to be rounded to the next whole number

10. CREDIT POINT AND CREDIT POINT AVERAGE

Credit Point (CP) of a course is calculated using the formula

CP = C x GP, where C = Credit; GP = Grade point

Credit Point Average (CPA) of a Semester/Programme is calculated using the formula

CPA = TCP/TC, where TCP = Total Credit Point; TC = Total Credit

Grades for the different semesters and overall programme are given based on the corresponding CPA as shown below:

CPA	Grade
Equal to 9.5 and above	*O - Outstanding*
Equal to 8.5 and below 9.5	*A+ - Excellent*
Equal to 7.5 and below 8.5	*A - Very Good*
Equal to 6.5 and below 7.5	*B+ - Good*
Equal to 5.5 and below 6.5	*B - Above average*
Equal to 5 and below 5.5	*C - Average*
Equal to 4 and below 5	*D - Pass*
Below 4	*F - Fail*

Note: A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 40% are required for a pass for 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 offered 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. Candidate who secures **D** grade and above will be eligible for higher studies.

11. MARKS DISTRIBUTION FOR EXTERNAL EXAMINATION AND INTERNAL EVALUATION

The external examination of all semesters shall be conducted by the College at the end of each semester. Internal evaluation is to be done by continuous assessment. **All the components of the internal assessment are mandatory.** Mark distribution

for external and internal assessments and the components for internal evaluation with their marks are shown below:

11.1 For all courses with practical

a) **Marks of theory - External Examination : 60**

b) **Marks of theory - Internal Evaluation : 10**

Components of Theory – Internal Evaluation	Marks
Attendance	**3**
Assignment/Seminar/Viva	**2**
Test Papers (2 x 2.5=5)	**5**
Total	**10**

c) **Marks of Practical - External Examination : 40**

(only in even semesters)

d) **Marks of Practical – Internal Examination : 20**

(odd and even semesters combined annually)

Components of Practical – Internal Evaluation	Marks
Attendance	**4**
Test Paper	**5**
Record*	**7**
Lab Involvement	**4**
Total	**20**

* Marks awarded for record should be related to the number of experiments recorded and duly signed by the concerned teacher in charge.

11.2 For all courses without practical

a) **Marks of external Examination : 80**

b) **Marks of internal evaluation : 20**

Components of Internal Evaluation	MARKS
Attendance	**5**
Assignment /Seminar/Viva	**5**
Two Test papers **(2x5=10)**	**10**

Total	**20**

11.3 Project Evaluation: (Max. marks 100)

(a) Marks of external examination : 80

(b) Marks of internal examination : 20

Components of External evaluation of Project	Marks
Dissertation (External)	50
Viva-Voce (External)	30
Total	**80**

Components of Internal evaluation of Project	Marks
Punctuality	5
Experimentation/Data collection	5
Knowledge	5
Report	5
Total	**20**

12. **Attendance Evaluation**

1) **For all courses with practical**

% of attendance	Marks for theory		% of attendance	Marks for practical
90 and above	3		90 and above	4
80 – 89	2		85 – 89	3
75 - 79	1		80-84	2
			75-79	1

2) **For all courses without practical**

% of attendance	Marks
90 and above	5
85 – 89	4
80-84	3
76-79	2
75	1

(Decimals are to be rounded to the next higher whole number)

13. **ASSIGNMENTS/SEMINAR/VIVA**

Assignments/Seminar/Viva is to be done from 1st to 5th Semesters. Each teacher can decide the mode of evaluation. The student shall appear for compulsory viva-voce in the 6th semester for each paper.

14. **INTERNAL ASSESSMENT TEST PAPERS**

Two internal test-papers are to be conducted in each semester for each course. 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 Department for three years and shall be made available for verification. The responsibility of evaluating the internal test papers is vested on the teacher(s), who teach the paper.

15. **EXTERNAL EXAMINATION**

The external examination of all semesters shall be conducted by the College at the end of each semester.

15.1 Students having a minimum of 75% average attendance for all the courses only can register for the examination. Condonation of shortage of attendance to a maximum of 10 days or 50 hours in a semester subject to a maximum of 2 times during the whole period of the programme may be granted by the Principal/Controller of Examination on valid grounds. This condonation shall not be counted for internal assessment.

Benefit of attendance may be granted to students attending University/College union/Co-curricular activities by treating them as present for the days of absence, on production of participation/attendance certificates, within one week, from competent authorities and endorsed by the Head of the institution. This is limited to a maximum of 10 days per semester and this benefit shall be considered for internal assessment also.

Those students who are not eligible even with condonation of shortage of attendance shall repeat the course along with the next batch.

15.2 All students are to do a **project in the area of core course**. This project can be done individually or as a group of 3 students. The projects are to be

identified during the II 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 at the sixth semester and are to be produced before the examiners appointed by the College. External project evaluation and Viva is compulsory for all subjects and will be conducted at the end of the programme.

15.3 A student who registers her name for the external exam for a semester will be eligible for promotion to the next semester.

15.4 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.

15.5 A candidate who has not secured minimum marks/credits in internal examinations can re-do the same registering along with the examination for the same semester, subsequently.

16. All programmes and courses shall have unique alphanumeric code.

17. **PATTERN OF QUESTIONS`**

Questions shall be set to assess knowledge acquired, standard application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. The question setter shall ensure that questions covering all skills are set. The question setter shall also submit a detailed scheme of evaluation along with the question paper. Question paper shall be a judicious mix of objective type, short answer type, short essay type /problem solving type and long essay type questions according to the question paper blue print given.

Pattern of questions for external examination for theory paper with practical

Pattern	Total no. of questions	No. of questions to be answered	Marks of each question	Total marks
Very Short Answer	**8**	**8**	**1**	**8**
Short Answer	**10**	**6**	**2**	**12**

Short Essay/Problem	**6**	**4**	**4**	**16**
Essay	**4**	**2**	**12**	**24**
	28	**20**	**X**	**60**

Pattern of questions for external examination for theory paper without practical

Pattern	Total no. of questions	No. of questions to be answered	Marks of each question	Total marks
Very short answer	**10**	**10**	**1**	**10**
Short Answer	**12**	**8**	**2**	**16**
Short essay/problem	**9**	**6**	**4**	**24**
Essay	**4**	**2**	**15**	**30**
	35	**26**	**X**	**80**

Each BOS shall specify the length of the answers in terms of number of words. Pattern of questions for external examination of practical papers will be decided by the concerned Board of Studies/ Expert Committees.

STRUCTURE OF UNDER GRADUATE PROGRAMME IN PHYSICS

Total Credits: 120

Semester I **Total Credits: 18**

No.	Course Title	Hrs/Week	Credits
1.	**Common course I** English I English II	 **5** **4**	 **4** **3**
2.	**Common Course II** Language	 **4**	 **4**
3.	**Core Course I** **Core Practical I**	**2** **2**	**2** **-**
4.	**Complementary course I-** Mathematics	**4**	**3**

5.	**Complementary course II-** Chemistry Theory Chemistry Practical	 **2** **2**	 **2** **-**
		25hrs	**18**

Semester 2 **Total Credits: 22**

No.	Course Title	Hrs/Week	Credits
1.	**Common course I** English I English II	 **5** **4**	 **4** **3**
2.	**Common Course II** Language	 **4**	 **4**
3.	**Core Course II** **Core Practical II**	**2** **2**	**2** **2**
4.	**Complementary course I-** Mathematics	**4**	**3**
5.	**Complementary course II-** Chemistry Theory Chemistry Practical	 **2** **2**	 **2** **2**
		25hrs	**22**

Semester 3 **Total Credits: 18**

No.	Course Title	Hrs/Week	Credits
1.	**Common course I** English I	 **5**	 **4**
2.	**Common Course II** Language	 **5**	 **4**
3.	**Core Course III** **Core Practical III**	**3** **2**	**3** **-**
4.	**Complementary course I-** Mathematics	**5**	**4**

5.	**Complementary course II-** Chemistry Theory Chemistry Practical	 **3** **2**	 **3** **-**
		25 hrs	**18**

Semester 4 **Total Credits: 22**

No.	Course Title	Hrs/Week	Credits
1.	**Common course I** English I	 **5**	 **4**
2.	**Common Course II** Language	 **5**	 **4**
3.	**Core Course IV** **Core Practical IV**	**3** **2**	**3** **2**
4.	**Complementary course I-** Mathematics	**5**	**4**
5.	**Complementary course II-** Chemistry Theory Chemistry Practical	 **3** **2**	 **3** **2**
		25 hrs	**22**

Semester 5 **Total Credits: 15**

No.	Course Title	Hrs/Week	Credits
1.	**Core Course V** **Core Practical V**	**3** **2**	**3** **-**
2.	**Core Course VI** **Core Practical VI**	**3** **2**	**3** **-**
3.	**Core Course VII** **Core Practical VII**	**3** **2**	**3** **-**
4.	**Core Course VIII** **Core Practical VIII**	**3** **2**	**3** **-**

5.	**Open Course**	**4**	**3**
6.	**Project**	**1**	**-**
		25 hrs	**15**

Semester 6 **Total Credits: 25**

No.	Course Title	Hrs/Week	Credits
1.	**Core Course IX** **Core Practical IX**	**3** **2**	**3** **2**
2.	**Core Course X** **Core Practical X**	**3** **2**	**3** **2**
3.	**Core Course XI** **Core Practical XI**	**3** **2**	**3** **2**
4.	**Core Course XII** **Core Practical XII**	**3** **2**	**3** **2**
5.	**Choice based course**	**4**	**3**
6.	**Project**	**1**	**2**
		25hrs	**25**

CONSOLIDATED SCHEME FOR B Sc PHYSICS MODEL I PROGRAMME (CORE COURSES)

Semester	Course Title	Hrs/Week	Credits	Total Credits
1	PH1CRT01: Understanding Physics PH1CRP01: Practical I	2 2	2 -	2
2	PH2CRT02: Basic Mechanics and Properties of Matter PH2CRP02: Practical II	2 2	2 2	4
3	PH3CRT03: Electronics PH3CRP03: Practical III	3 2	3 -	3
4	PH4CRT04: Electricity, Magnetism and Electrodynamics PH4CRP04: Practical IV	3 2	3 2	5
5	PH5CRT05: Classical and Modern Optics PH5CRP05: Practical V	3 2	3 -	3
	PH5CRT06: Classical Mechanics and Relativity PH5CRP06: Practical VI	3 2	3 -	3
	PH5CRT07: Digital Electronics and Programming PH5CRP07: Practical VII	3 2	3 -	3
	PH5CRT08: Environmental Physics and Human Rights PH5CRP08: Practical VIII	3 2	3 -	3
	PH5OPT01:Open Course	4	3	3
	PROJECT	1	-	-
6	PH6CRT09: Quantum Mechanics and Spectroscopy PH6CRP09: Practical IX	3 2	3 2	5
	PH6CRT10: Solid State Physics PH6CRP10: Practical X	3 2	3 2	5
	PH6CRT11: Nuclear Physics, Particle Physics and Astro Physics PH6CRP11: Practical XI	3 2	3 2	5
	PH6CRT12: Thermodynamics and Basic Statistical Physics PH6CRP12: Practical XII	3 2	3 2	5
	PH6CBT01/02/03: Choice Based Course	4	3	3
	PROJECT	1	2	2

SCHEME FOR COMPLEMENTARY COURSE (FOR MATHEMATICS AND CHEMISTRY)

Semester	Course Title	Hrs/Week	Credits	Total Credits
1	PH1CMT01: Properties of Matter, Mechanics and Waves PH1CMP01: Practical I	2 2	2 -	2
2	PH2CMT02: Thermodynamics, Fluid Dynamics, Electric and Magnetic Phenomena PH2CMP02: Practical II	2 2	2 2	4
3	PH3CMT03: Elements of Modern Physics and Electronics PH3CMP03: Practical III	3 2	3 -	3
4	PH4CMT04:Optics and Superconductivity PH4CMP04: Practical IV	3 2	3 2	5

EXAMINATION SCHEME: CORE COURSE WITH PRACTICAL

Semester	Title of Course	No. of credits	Exam Duration	Total marks	
				Internal	External
1	Core-1 Theory	2	3	10	60
2	Core-2 Theory	2	3	10	60
	Practical I & II	2	3	20	40
3	Core-3 Theory	3	3	10	60
4	Core-4 Theory	3	3	10	60
	Practical III & IV	2	3	20	40
5	Core-5 Theory	3	3	10	60
	Core-6 Theory	3	3	10	60
	Core-7 Theory	3	3	10	60
	Core-8 Theory	3	3	10	60
	Open course Theory	3	3	20	80
VI	Core-9 Theory	3	3	10	60
	Practical V & IX	2	3	20	40
	Core-10	3	3	10	60
	Practical VI & X	2	3	20	40
	Core-11 Theory	3	3	10	60
	Practical VII & XI	2	3	20	40
	Core-12 Theory	3	3	10	60
	Practical VIII & XII	2	3	20	40
	Choice based course Theory	3	3	20	80
	Project	2		20	80
Total		54		300	1200

SYLLABUS FOR CORE & COMPLEMENTARY COURSES

B Sc Physics Programme (Model I)

Semester-1

Core Course: I **36 hours (Credit – 2)**

PH1CRT01: UNDERSTANDING PHYSICS

Module I

Historical Evolution of Physics **(9 hours)**

An overview on ancient perspectives on the universe - Galileo, and his emphasis on experiments and observations, Kepler's laws, Newton and the deterministic universe, Maxwell and the unification of electricity, magnetism and optics, Fundamental particles and the unification of all forces of nature.

Planck's hypothesis of quantum, Quantum mechanics, Einstein and his theories of relativity, Contributions by the Great Indian Scientists - S. N. Bose, M. N. Saha, C. V. Raman, quantum theory of Raman effect Chandrasekhar's limit (details and derivations not required)

References:

www.britannica.com. This online Encyclopedia is a good resource for this module

Vignettes in Physics, G. Venkataraman, Universities Press

Module II

Measurement of Lengths and Angles **(9 hours)**

Length measurement – rulers – standard metre – Vernier calipers - micrometers – screw gauges – travelling microscope – laser range finder- sonar, RADAR, GPS.

Angle measurement – spectrometer - scale and telescope - measurement of stellar parallaxes.

Module III

Electrical Measurement and Transducers **(8 hours)**

Electrical measurement - Working principle of dc voltmeter, dc ammeter.

Transducers - introduction, Electrical transducer, classification – active and passive, basic idea on resistive transducer and strain gauge (classification not required) , thermistor

Text Book: Electronic Instrumentation, H S Kalsi, TMG Publishing Company Ltd, Second Edition.

Module IV **(10 hours)**

Error Analysis

Calibration – need for calibration

Performance characteristics of an instrument – static characteristics – Error in measurement, Types of static error – Gross error, systematic errors, random errors, sources of error.

Statistical analysis – arithmetic mean, deviation from the mean, average deviations, standard deviation, limiting errors, graphical representation of measurements as a distribution.

Propagation of errors – sum and differences – products and quotients – multiplying by constants – powers.

Text Book: Electronic Instrumentation, H S Kalsi, TMG Publishing Company Ltd, Second Edition.

References:

1. http:www.howstuffworks.com/
2. An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, John R. Taylor, Univ. Science Books
3. Instrumentation devices and systems, C S Rangan, G R Sarma, V S V Mani, Second Edition.
4. http://www.upscale.utoronto.ca/PVB/Harrison/ErrorAnlaysis

Semester-2

Core Course: II **36 hours (Credit – 2)**

PH2CRT02: BASIC MECHANICS AND PROPERTIES OF MATTER

Module I

Rotational Mechanics **(10 hours)**

Translational and rotational motion of a rigid body, torque, angular momentum, conservation of angular momentum, moment of inertia, Parallel and perpendicular axes theorem, calculation of moment of inertia- (rod, circular ring, disc, solid cylinder, solid sphere), flywheel.

Module II

Oscillations **(10 hours)**

Periodic motion, simple harmonic motion and harmonic oscillator, differential equation of SHM, energy of a harmonic oscillator, compound pendulum – Symmetric and Unsymmetric Pendulum, anharmonic oscillator, damping force, damped harmonic oscillator, quality factor, forced harmonic oscillator, resonance.

Module III

Elasticity **(10 hours)**

Basic ideas on elasticity, relations connecting various elastic constants, bending of beams, bending moment, cantilever-derivation of expression for depression at loaded point, cantilever- Young's modulus (mirror and telescope), Non-Uniform bending, I –section girders, Uniform bending, torsion of a cylinder-angle of twist and angle of shear, torsion pendulum, determination of rigidity modulus using torsion pendulum (dynamical method), static torsion method.

Module IV

Surface Tension and Viscosity **(6 hours)**

Surface Tension, Explanation of surface tension based on Molecular theory, Surface Energy, Angle of contact (experiment not required), Capillarity, Expression for Surface tension, Applications.

Viscosity-(Stream line and turbulent flow, Critical velocity, Stokes formula-derivation)* Derivation of Poiselleuis formula, Determination of coefficient of viscosity- constant pressure head and variable pressure head methods, Lubricants.

Topics for self study

Text Book: Mechanics & Properties of Matter, Dr. Anand V Karthik, P. Vivekanandan, Mahatma Gandhi University, Kottayam, Chapter 4.

References:

1. Mechanics , J.C. Upadhayaya, Ramprasad publications
2. Mechanics, D. S. Mathur, S. Chand publications
3. Properties of Matter, Brij Lal and Subrahmanyam.
4. Properties of Matter and Acoustics , Murugeshan and K. Sivaprasath, S. Chand
5. Mechanics, Hans and Puri, TMH
6. Mechanics, D.S. Mathur and P.S. Hemne, S. Chand.
7. Properties of Matter, Mathur, S. Chand.
8. Mechanics, Somnath Datta, Pearson.
9. Mechanics, H.D Young and R.A Freedman, Pearson.

Semester-3

Core Course: III **54 hours (Credit – 3)**

PH3CRT03: ELECTRONICS

Module I

Semiconductor Diodes and Applications **(15 hours)**

*Basic concepts of PN Junction diode

Avalanche and Zener breakdown, Zener diode.

Rectifiers and filters- Half wave, Full wave- Centre tapped, Bridge rectifier circuits, Derivation of ripple factor & efficiency of rectifier circuits.

Filter circuits, Inductor Filter, Capacitor Filter, LC Filter, π filter.

Voltage regulation, Line regulation and load regulation, Zener diode shunt regulator, Optimum value of current limiting resistor.

Wave shaping circuits- Clipper-Positive, negative and biased, Clamping circuits- biased clampers, Voltage multipliers – Doubler, Trippler and Quadrupler.

**** Topic for Self study***

Module II

Transistors **(18 hours)**

Bipolar junction transistors – construction, symbol, Operation of PNP and NPN transistor, Transistor circuit configuration - CB, CC, CE and current gain in each case, Characteristics, Active, saturation and cut-off regions, Leakage currents, Thermal runaway.

Transistor Biasing – DC operating point and load line, Q-Point, Stability Factor, Methods of transistor biasing – Base bias, Base bias with emitter feedback, Base bias with collector feedback, voltage divider bias (Stability factor of each biasing not required).

JFET- n channel & p channel, Characteristics of FET- Drain & Transfer, JFET parameters, Comparison between FET and BJT, MOSFET – working of depletion and enhancement mode (Only basic ideas on FET and MOSFET required)

Module III

Amplifiers and Oscillators **(12 hours)**

Introduction to amplification, CE amplifier – analysis of CE amplifier, CE amplifier parameters, Principle of feedback amplifiers, Positive and Negative feedback and its effect, Types of feedback connections (block diagram only), Emitter follower.

Introduction to oscillators, Principle of oscillators, Barkhausen criterion, Tuned collector oscillator, Hartley and Colpitt's oscillators, RC Phase shift oscillator, Crystal oscillator.

Module IV

Operational Amplifiers **(9 hours)**

Introduction, Symbols and terminals, Op-Amp Supply Voltage, Op-Amp Parameters, Op Amp as a voltage amplifier, Ideal Op amp, Op-amp circuits- inverting, non-inverting, voltage follower, summing amplifier, integrator, differentiator

Text Book: A Text Book of Applied Electronics, R. S. Sedha

References:

1. Basic Electronics Solid State, B L Theraja, Muticolour Edition, S Chand Publications
2. Principles of Electronics, V.K. Mehta, S.Chand Co.
3. Electronic Devices and Circuit Theory, Robert L Boylestad & Louis Nashelsky, PHI
4. Electronic Principles and Applications, Schuler McGrawHill
5. Foundations of Electronics, D Chattopadhyay, P.C.Rakshit, B Saha, N.N.Purkait New Age International Publishers

Semester-4

Core Course: IV **54 hours (Credit – 3)**

PH4CRT04: ELECTRICITY, MAGNETISM AND ELECTRODYNAMICS

Module I

Electrostatics **(14 hours)**

Review (Scalar and vector fields, Gradient, divergence, Curl and their physical significance). Electric field- Continuous charge distribution, Divergence and curl of electrostatic fields, Gauss' Law, Applications (uniformly charged solid sphere, uniformly charged cylinder, uniformly charged wire, infinite plane sheet of charge, oppositely charged parallel plates), Electric potential, 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.

Module II

Magnetostatics **(9 hours)**

Lorentz force law, Magnetic force due to line current, surface current and volume current, The Biot-Savart law, The divergence and Curl of B, Ampere's law and applications, Magnetic vector potential, Comparison of electrostatics and magnetostatics.

Module III

Electrodynamics, Maxwell's Equation & Electromagnetic Waves **(12 hours)**

Ohms law, electromotive force, motional emf, electromagnetic induction, induced electric field, Maxwell's equations, Conservation laws, charge and energy, continuity equation, Poyntings theorem, Electromagnetic waves in vacuum-wave equations for E and B monochromatic plane waves-energy and momentum of electromagnetic waves.

Module IV

Transient Currents **(8 hours)**

Growth and decay of current in an LR circuit, Charging and discharging of a capacitor through a resistor- Measurement of high resistance by leakage, BG, Growth and decay of charge in an LCR circuit.

Alternating Currents & Network Theorems (11 hours)

EMF induced in a coil rotating in a magnetic field, Analysis of LCR series circuits, LCR parallel resonant circuit, comparison, Power in ac circuits, Wattless current, choke coil transformer, skin effect.

Ideal voltage source and current source, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem.

Text Books:

1. Introduction to Electrodynamics, David J Griffiths, PHI, Chapters 2,5,7,8 and 9

2 .Electricity and Magnetism, R. Murugeshan, Chapters 12, 13 and 18

References:

1. Electricity and Magnetism, J.H.Fewkes & John Yarwood, University Tutorial Press
2. Fundaments of Magnetism and Electricity, D N Vasudeva, S Chand
3. Electricity and Magnetism, A S Mahajan and AA Rangwala, TMH
4. Electromagnetics, Matthew N Sadiku, Oxford 4th Edn

Semester- 5

Core Course: V **54 hours (Credit – 3)**

PH5CRT05: CLASSICAL AND MODERN OPTICS

Module I

Interference **(14 hours)**

Review of basic ideas of interference (Coherent waves, superposition of waves, theory of interference, Young's double slit experiment, condition for interference)

Thin films-plane parallel film, interference due to reflected light, conditions for brightness and darkness, interference due to transmitted light, Haidinger fringes, interference in wedge shaped film, colours in thin films, Newton's rings. Michelson interferometer -construction and working, circular fringes, measurement of wavelength, thickness of a thin transparent sheet.

Module II

Diffraction **(13 hours)**

Fresnel Diffraction, Huygens, Fresnel theory, zone plate (concept only), distinction between interference and diffraction, diffraction pattern due to a straight edge, narrow silt.

Fraunhoffer diffraction at a single slit, double slit (geometric method only), theory of plane transmission grating. Dispersive power of grating.

Module III

Polarization **(13 hours)**

Introduction, preferential direction in a wave, polarized light, production of linearly polarized light. Anisotropic crystals, calcite crystal, Huygens explanation of double refraction. Superposition of waves linearly polarized at right angles, types of polarized light. Wave plates, Production and Detection of plane, elliptically and circularly polarized light. Optical Activity (qualitative idea only), specific rotation.

Module IV

Laser **(14 hours)**

Attenuation of light in an optical medium, thermal equilibrium, interaction of light with matter, Einstein's relations, light amplification, population inversion, active medium, pumping, metastable states, principal pumping schemes, optical resonator, axial modes. Types of lasers, semiconductor laser, Q switching, applications.

Holography – principle of holography, application.

Text Book: Optics by N.Subramanayam, Brijlal, M.N Avadhanulu, Chapters 14,15, 17,18, 22, 23

References:

1. Optics, Ajoy Ghatak, TMH, Third edition
2. Optical Electronics, Ajoy Ghatak and K Thyagarajan, Cambridge
3. Optics and Atomic Physics, D P Khandelwal, Himalaya Pub. House
4. Optics, S K Srivastava, CBS Pub. N Delhi
5. A Text book of Optics, S L Kakani, K L Bhandari, S Chand.

Semester- 5

Core Course: VI **54 hours (Credit – 3)**

PH5CRT06: CLASSICAL MECHANICS AND RELATIVITY

Module I

Fundamentals of Newtonian Mechanics **(14 hours)**

Frames of reference- Cartesian, plane polar, cylindrical and spherical polar co-ordinates - Newton's laws of motion - first, second and third laws - Inertial frames and non-inertial frames - Mechanics of a particle - conservation of linear momentum, angular momentum and torque, conservation of angular momentum, work done by a force, conservative force, conservation of energy. Motion under a constant force - Motion under Time-dependent force - Motion under velocity dependent force - Motion of charged particles in magnetic fields.

Text Book: Classical Mechanics, G. Aruldhas, Prentice Hall of India. Chapter 1

Module II

Central Force Problem **(10 hours)**

Reduction to one-body problem - General properties of central force motion- angular momentum, law of equal areas - Effective potential - Classification of orbits - Motion in central force field- general solution - Inverse square law force - Kepler's laws - Law of gravitation from Kepler's laws.

Text Book: Classical Mechanics, G. Aruldhas, Prentice Hall of India. Chapter 5

Module III

Lagrange and Hamilton Equations **(16 hours)**

Constraints - Holonomic constraints, Non-holonomic constraints, Scleronomous and Rheonomous constraints. Generalized coordinates – Degrees of freedom, Generalised coordinates, Configuration space. Principle of virtual work – D'Alemberts Principle -

Lagrange's equations - Velocity dependent potential – The Hamiltonian of a system – Hamilton's equations of motion.

Text Book: Classical Mechanics G. Aruldhas, Prentice Hall of India. Chapter – 3,6

Module IV

Relativity **(14 hours)**

Special Relativity - Time dilation - Doppler effect - Length contraction - Twin Paradox - Electricity and Magnetism - Relativistic momentum - Mass and Energy - Energy and Momentum- General Relativity- Lorentz transformation.

Text Book: Concepts of Modern Physics, Arthur Beiser Sixth Edition- Chapter 1.

References:

1. Classical Mechanics, Goldstein, Poole & Safko, Pearson 3rd Edition
2. Classical Mechanics, K. Sankara Rao, Prentice Hall of India.
3. University Physics, Harris Benson, Wiley.
4. Physics for scientists and engineers with modern physics, J.W. Jewett, R.A. Serway, Cengage, 9th Edition

Semester- 5

Core Course: VII **54 hours (Credit – 3)**

PH5CRT07: DIGITAL ELECTRONICS AND PROGRAMMING

Module I

Number Systems and Boolean Algebra

(10 hours)

Review of Number Systems, Subtraction with 2's complement and 1's complement, BCD Code.

Binary logic- AND, OR and NOT operators- Logic symbol and truth table-Laws of Boolean algebra- Demorgan's theorem- Duality theorem- Boolean functions- Complement of a function- Conversion between truth table, Boolean expressions and Logic diagrams, NAND, NOR, XOR, XNOR gates

Text Books:

1. Digital Circuits and Design, S Salivahanan and S Arivazhakan, PHI

2. Digital Design, M Morris Mano PHI Chapter 1, 2, 3

3. Digital Fundamentals, Floyd- Thomas L Floyd

4. Digital Design, M Morris Mano PHI Chapter 2, 3

Module II

Combinational Logic Circuits **(10 hours)**

Adders- Half and Full adders- Half and Full Subtractor, Four bit parallel adder, Subtractor, Decoders- 3- to– 8 decoder, Encoders- Octal –to- binary encoder

Text Books:

1. Digital Circuits and Design, S Salivahanan and S Arivazhakan, PHI

2. Digital Design, M Morris Mano, PHI, Chapter 4,5,6,7

Module III

Sequential Logic Circuits **(8 hours)**

Flip-flops, RS, Clocked RS, MSJK FF, DFF JK, Buffer registers- Shift register, D/A converters (Ladder type)

Text Books:

1.Digital Circuits and Design, S Salivahanan and S Arivazhakan, PHI

2. Digital Design, M Morris Mano PHI Chapter 4,5,6, 7

Module IV

Numerical Methods and Programming **(20 hours)**

Iteration principle, Newton-Raphson methods, numerical integration-trapezoidal rule and Simpson's 1/3 rule, Numerical solution of differential equation- Euler's method, second order Runge-Kutta method.

C++ programming basics - preprocessor directives-declarations and definitions-manipulators-arithmetic operators-library functions- loops and decisions- for loop, while loop, do loop, if, if…else, else if, switch statements , conditional operator, logical operators, break statement, continue statement, go to statement.

Functions (qualitative only)

Algorithm and program development using C^{++} **(6 hours)**

1. Newton-Raphson methods
2. Runge-Kutta Method
3. Euler's method
4. Trapezoidal Rule

Text Book: Object Oriented Programming With C++, E. Balaguruswamy, 6e, McGraw Hill Education.

References:

1. Digital Fundamentals, Thomas L. Floyd (10th edition), Pearson

2. Digital Principles and Aplications, 6th Edn., Malvino, Leach and Saha TMH
3. Digital Electronics, Sedha S Chand
4. Object – Oriented Programming in Turbo C++, Robert Lafore, Galgotia

Semester- 5

Core Course: VIII **54 hours (Credit – 3)**

PH5CRT08: ENVIRONMENTAL PHYSICS AND HUMAN RIGHTS

Module I

Natural Resources **(8 hours)**

Natural resources and associated problems (use and over exploitation of each):

(a) Forest resources (b) Water resources (c) Mineral resources (d) Food resources (e) Energy resources

Text Book: Text Book of Environmental Studies for undergraduate courses, Bharucha Erach, University Press, IInd Edition 2013

Energy Sources **(10 hours)**

Various forms of energy - non- renewable energy sources:- coal, oil, natural gas; merits and demerits - renewable energy sources:- solar energy, biomass energy, biogas energy, wind energy, wave energy, tidal energy, hydro energy, geothermal, fusion energy, hydrogen; merits and demerits.

Text Books:

1. Renewable Energy sources; Their impact on Global Warming and Pollution, Tasneem Abbasi and S.A. Abbasi, PHI Pvt. Ltd

2. Non- Conventional Energy Resources, D.S Chauhan and S.K Srivastava, New Age International

Module II

Solar Energy Utilization **(12 hours)**

Sun as a source of energy - solar radiation - spectral distribution - flat plate collector- Concentrating collector: Focussing type and non-focussing type- solar pond-application- solar water heating-different types of solar water heaters - solar heating of buildings-different types- solar dryer – direct and indirect type - solar cooker – different types of solar cooker - solar green houses- types of green houses and advantages-solar photovoltaics - working principle.

Text Book: Non-conventional Energy Sources, G.D. Rai, Khanna Publisher.

Module III

Environmental Pollution **(8 hours)**

Introduction- Definition, causes, effects and control/treatment methods of: (i) air pollution, (ii) water pollution, (iii) soil pollution, (iv) marine pollution, (v) noise pollution, (vi) Thermal pollution, (vii) nuclear hazards.

Solid waste management: Causes, effects and control measures of urban and industrial wastes.

Text Books:

1. ***Essential Environmental Studies, S.P Misra, S.N Pandey, Ane Books Pvt Ltd***
2. ***Environmental Science: Principles and Practice-, R.C. Das and D.K. Behera, PHI Pvt. Ltd***
3. ***Environmental Chemistry and Pollution Control, S.S Dara, S. Chand***

Environment Impact Assessment and Control **(8 hours)**

Environmental ethics: Issues and possible solutions – Environment Protection Act- Air (Prevention and control of Pollution) Act- Water (Prevention and control of Pollution) Act- Wildlife Protection Act- Forest Conservation Act.

Text Book: Text Book of Environmental Studies for Undergraduate Courses, Bharucha Erach (University Press, IInd Edition 2013)

Module IV

Human Rights **(8 hours)**

Human Rights-Concept, Origin and Definitions-Types of Human Rights-UNO and UDHR-Human Rights and Indian Constitution-Contemporary Human Rights Issues-Women Rights-Child Rights-Rights of Minorities and Dalit's-HIV/AIDs-National and State Human Rights Commission.

Text Books:

1. Amartya Sen, The Idea Justice, New Delhi: Penguin Books, 2009

2. Chatrath, K. J.S., Education for Human Rights and Democracy, Shimla: Indian Institute of Advanced Studies, 1998

3. Law Relating to Human Rights, Asia Law House, 2001

References

1. Essential Environmental Studies S.P Misra, S.N Pandey, Ane Books Pvt Ltd
2. Environmental Science: Principles and Practice, R.C. Das and D.K. Behera, PHI Pvt. Ltd
3. Environmental Chemistry and Pollution Control, S.S Dara, S. Chand
4. Environmental Science, G Tyler Miller, Cengage Learning
5. Introduction to Environmental Science, Y Anjaneyulu, B S Publications
6. Introduction to Environmental Engineering and Science, G.M. Masters and W.P. Ela, PHI Pvt. Ltd
7. Environmental Management, B. Krishnamoorthy, PHI Pvt. Ltd
8. Solar Energy-Fundamentals and Applications, H.P. Garg and J. Prakash, Tata Mc Graw Hill
9. Solar Energy-Fundamentals, Design, Modeling and Applications, G.N. Tiwari, Narosa Pub. House

Semester- 5

Open Course: I **72 hours (Credit – 3)**

PH5OPT01: OPEN COURSE- PHYSICS IN DAILY LIFE

Module I

Introduction to Physics **(8 hours)**

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

Motion **(12 hours)**

Velocity, acceleration, momentum, Idea of inertia, force - laws of motion, law of conservation of momentum-applications. Newton's law of gravitation, acceleration due to gravity, mass and weight, apparent weight, weightlessness.

Module II

Light **(18 hours)**

Reflection, refraction, diffraction, interference, scattering (elementary ideas only) – examples from daily life – apparent depth, blue colour 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.

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

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

Matter and Energy **(12 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.

Module IV

Universe **(12 hours)**

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

Text books:

1. ***Concepts of Physics, Vol.1, H. C. Verma, Bharati Bhawan Publishers***
2. ***Concepts of Physics, Vol.2, H. C. Verma, Bharati Bhawan Publishers***
3. ***Modern Physics, R. Murugeshan, S. Chand Publishers***

Reference:

1. Principles of Physics, Resnick and Halliday, Wiley Publications

Semester- 6

Core Course: IX **54 hours (Credit – 3)**

PH6CRT09: QUANTUM MECHANICS AND SPECTROSCOPY

Module I

Historical Development and Origin of Quantum Theory (10 hours)

Failure of classical physics, Black Body radiation, Planck's radiation law, Photoelectric effect-Einstein's explanation, Wave Particle Dualism-Dual nature of light-Compton effect, Dual nature of matter- De Broglie hypothesis, Davisson-Germer Experiment, De Broglie waves, Group and phase velocities, Uncertainty principle, Applying uncertainty principle.

Text Book: A Textbook of Quantum Mechanics, G Aruldhas, Chapter 1

General Formalism of Quantum Mechanics (4 hours)

Wave function, Eigen functions and eigen values, Postulates of Quantum Mechanics, Orthogonality, Normalization, Operators- position, momentum, energy and angular momentum, Expectation value, Hermitian operators, properties of Hermitian operators, Probability Density and Probability current density.

Text Book: A Textbook of Quantum Mechanics, G Aruldhas, Chapter 3 and 8

Module II

Schrodinger Equation and its Applications (14 hours)

Time dependent Schrodinger equation, interpretation of wave function, Ehrenfest theorem, Extension to three dimensions, Time independent Schrödinger equation, Stationary states, Admissibility conditions of wave function, general properties of one dimensional Schrödinger equation, harmonic oscillator (result only), particle in a box-solution.

Text Book: A Textbook of Quantum Mechanics, G Aruldhas, Chapter 2 and 4.

Module III

Atomic Spectroscopy **(10 hours)**

Bohr atom model- Hydrogen spectrum-Sommerfield relativistic atom model– electron spin and magnetic moment - Exclusion principle - Stern- Gerlach experiment - Vector atom model - quantum numbers associated with vector atom models- Total angular momentum and LS coupling–selection rules-intensity rules- fine structure of Hydrogen. Zeeman effect- normal and anomalous Zeeman effect (concepts only) – Paschen– Back effect (concepts only).

Text Book: Modern Physics, G. Aruldhas and P Rajagopal, PHI

Module IV **(16 hours)**

Molecular Spectroscopy

Molecular energy levels. Electronic, rotational and vibrational energies – Classification of molecules- rotational spectra of diatomic molecule –rotation vibration transitions– Fluorescence and phosphorescence – Raman effect – experimental arrangement and results - classical theory and its failure – quantum theory of Raman effect.

Text Books:

1. ***Modern Physics, G. Aruldhas and P Rajagopal, Prentice Hall of India***
2. ***Fundamentals of Molecular Spectroscopy, C. Banwell and E. Mccash; Tata McGraw-Hill***
3. ***Molecular structure and Spectroscopy, G. Aruldhas, Prentice Hall of India***

References:

1. Concepts of modern Physics, Arthur Beiser.
2. Fundamentals of Molecular Spectroscopy, C. Banwell and E. Mccash.
3. Molecular structure and Spectroscopy, G. Aruldhas.
4. Classical Mechanics, K. Sankara Rao, Prentice Hall of India
5. Introduction to Atomic Spectra, H. E. White
6. Modern Physics, R. Murugeshan

Semester- 6

Core Course: X **54 hours (Credit – 3)**

PH6CRT10: SOLID STATE PHYSICS

Module I

Crystal Structure **(16 hours)**

Crystal Structure - Crystalline Matter - Bravais Lattice - Crystal Systems – Crystal Planes and Miller Indices - Lattice Constants - Reciprocal Lattice – Crystal Structures - sc, bcc, fcc and hcp - Bragg's Law - Experimental Methods of X-Ray diffraction - Powder method.

Bonding in Solids - Ionic, Covalent, Van der Waal and Metallic Bonding (qualitative) - Binding Energy in Crystals - Madelung Constant.

Text Books:

1. ***Solid State Physics, S O Pillai, Chapter 4***
2. ***Solid State Physics, M A Wahab, Chapter 1, 2***

Module II

Band Theory of Semiconductors **(10 hrs)**

Free carrier concentration in semiconductors, Fermi level and carrier concentration in semiconductors, mobility of charge carriers, effect of temperature on mobility, electrical conductivity of semiconductors, Hall Effect in semiconductors.

Text Books:

1. ***Solid State Physics, M A Wahab, Chapter 13***
2. ***Solid State Physics, S O Pillai, Chapter 6***

Module III

Dielectric Properties of Materials **(8 hours)**

Dipole moment-Polarization- local electric field of an atom (no derivation)- dielectric constant – polarizability- piezo-pyro and ferroelectric properties of crystals.

Text Book: Solid State Physics, M A Wahab- Chapter 14

Magnetic Properties of Materials **(10 hours)**

Response of materials to magnetic field, classification of magnetic materials, Langevin's Classical theory of diamagnetism and paramagnetism, ferromagnetism, Weiss molecular field- ferromagnetic domains, (basic ideas only).

Text Book: Solid State Physics, M A Wahab, Chapter 16

Module IV

Superconductivity **(10 hours)**

Origin of superconductivity, response of magnetic field, Meissner effect, super current and penetration depth, critical field and critical temperature, type-I and type –II superconductors, thermodynamic and optical properties, isotope effect, Josephson effect and tunnelling elements of BCS theory-Cooper pairs-Existence of bandgap, SQUID, High Tc superconductors and applications.

Text book: Solid State Physics, Puri and Babbar, Chapter 8, 9 and 10

References

1. Kittel, C., Introduction to Solid State Physics, 8th edition (Wiley)
2. Ashcroft, N.W. & Mermin, N.D. Solid State Physics, TMH
3. Blakemore, J.S. Solid State Physics, 2nd edition (Cambridge)
4. C.L. Arora, Solid State Physics. S Chand.
5. S. O. Pillai, Solid State Physics. New Age International Pub.

Semester- 6

Core Course: XI **54 hours (Credit – 3)**

PH6CRT11: NUCLEAR PHYSICS, PARTICLE PHYSICS AND ASTROPHYSICS

Module I

Nuclear Structure & General Properties of Nuclei (14 hours)

Classification of nuclei, General properties of nucleus – size, nuclear mass, density, charge, angular momentum, nuclear magnetic dipole moments, electric quadrupole moment, Binding Energy, BE 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-Nuclear shell model - Collective model, Determination of nuclear mass by Bainbridge's mass spectrograph. Detectors of nuclear radiations – ionisation chamber - G.M Counter.

Text Book: Modern Physics, R. Murukeshan, Er. Kiruthiga Sivaprasanth, S. Chand Publications, Chapters 5, 27 and 29

Module II

Radioactivity (14 hours)

Natural radioactivity–Alpha, Beta and Gamma Rays- properties, Gamow's Theory of alpha decay, Beta decay- Neutrino theory, origin of Gamma rays, nuclear isomerism, internal conversion, Mossbauer effect, Soddy Fajan's displacement law, Radioactive series, Law of radioactive disintegration, Mean life, measurement of decay constants, units of radioactivity, Radioactive dating, Artificial radioactivity, Applications of radioisotopes.

Text Book: Modern Physics, R. Murukeshan, Er. Kiruthiga Sivaprasanth, S. Chand Publications, Chapters 31 and 34

Module III

Nuclear Fission and Fusion (10 hours)

Nuclear fission, Energy released in fission, Bohr-Wheeler's theory, Chain reaction, Atom bomb, Nuclear reactors, Nuclear fusion, Sources of stellar energy, Thermonuclear reactions, Fusion reactors

Text Book: ***Modern Physics, R. Murukeshan, Er. Kiruthiga Sivaprasanth, S. Chand Publications,*** **Chapter 35.**

Astrophysics **(6 hours)**

Classification of star, HR diagram, Luminosity, Stellar Evolution, White dwarfs, Chandrasekhar limit, Neutron stars, Black hole, supernova explosion, Photon diffusion time.

Text Book: Modern Physics, R. Murukeshan, Er. Kiruthiga Sivaprasanth, S. Chand Publications, **Chapter 78.**

Module IV

Elementary Particles **(10 hours)**

Elementary particles, classifications, particles and antiparticles, antimatter, fundamental interactions, Elementary particle quantum numbers, conservation law and symmetry. Quark model (basic idea only).

Particle accelerators - Van de Graff generator, linear accelerator, cyclotron and Betatron.

Text Book: Modern Physics, R. Murukeshan, Er. Kiruthiga Sivaprasanth, S. Chand Publications, Chapter 30 and 38.

Cosmic Rays

Cosmic rays, Latitude effect, Azimuth effect, Altitude effect, primary and secondary cosmic rays, cosmic ray showers, Van Allen belts, Origin of cosmic rays

Text Book: Modern Physics, R. Murukeshan, Er. Kiruthiga Sivaprasanth, S. Chand Publications, **Chapter 37.**

References:

1. Atomic and Nuclear Physics, S N Ghoshal, S.Chand.
2. Nuclear Physics, D C Tayal, Himalaya Publishing House
3. Elements of Nuclear Physics, M L Pandya and R P S Yadav

4. Modern Physics, Arthur Beiser, TMH
5. An Introduction to Astrophysics- Baidyanath Basu

Semester- 6

Core Course: XII **54 hours (Credit – 3)**

PH6CRT12: THERMODYNAMICS AND BASIC STATISTICAL PHYSICS

Module I

Laws of Thermodynamics **(18 hours)**

Laws of Thermodynamics: Zeroth law. First law, internal energy, Applications of first law, Indicator diagram, Work done during isothermal and adiabatic process, slopes, relation between them, cooling due to Adiabatic reversible processes . Reversible and irreversible processes, Second law, Heat Engines, Carnot cycle and theorem, Work done by the engine per cycle, efficiency, Petrol engine, Diesel Engine, Third law of thermodynamics.

Module II

Entropy **(7 hours)**

Entropy, change in entropy in reversible and irreversible process, change in entropy in adiabatic process, principle of increase of entropy, physical significance of entropy, TS diagram, Entropy of a perfect gas in terms of thermodynamics variables, Heat death of Universe.

Thermodynamic Relations **(6hours)**

Thermodynamic potentials, Maxwell's thermodynamic relations, TdS equations, Clausius Clapeyron's equation- Applications

Module III

Heat Transmission **(7 hours)**

Modes of heat transfer, Thermal conductivity of Good Conductors - Searle's & Lee's method, Thermal conductivity of bad conductors – Lee's Disc Method, black body radiation, Stefans-Boltzmann Law, Wein's displacement law

Module IV

Statistical Physics **(16 hours)**

Introduction, Macro and Micro states, Phase space, gamma space, Principle of equal a prori probability, Thermodynamic Probability, Statistical Ensembles

Introduction to Classical and Quantum Statistics, Distinction between three types of particles, MB statistics, Maxwell's law of distribution of velocities, Entropy and thermodynamics probability, Gibbs Paradox.

Need of quantum statistics, BE statistics, FD statistics.

Text Book: Thermodynamics and Statistical Physics, Brij Lal, N.Subrahmanyam and P S Hemne ,S. Chand &Co, Multi colour edition 2007

References:

1. Heat and Thermodynamics, Mark W Zemaskay and Richard H Dittman, Tata McGraw-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

Semester-6

Choice Based Core Course – I **Credit-3 (72 hours)**

PH6CBT01: NANOSCIENCE AND NANOTECHNOLOGY

Module I **(8 hours)**

Introduction

Nanoscience and Nanotechnology - Nanostructures: Zero, One Two and Three dimensional nanostructures, applications of nanotechnology

Band Structure and Density of State at nanoscale: Energy Bands, Density of States at low dimensional structures.

Text Book: **Introduction to Nanoscience and Nanotechnology, Chattopadhyaya and Banerjee, PHI Pub., 2014, Chapter-3**

Module II

Introductory Quantum Mechanics for Nanoscience **(10 hours)**

Size effects in small systems, Quatum behaviour of nanometric world: Applications of Schrodinger equation – infinite potential well, potential step, potenial box; trapped particle in 3D (nanodot), electron trapped in 2D plane (nanosheet), electrons moving in 1D (nanowire, nanorod, nanobelt), Excitons, Quantun confinement effect in nanomaterials

Text Book: Introduction to Nanoscience and Nanotechnology, Chattopadhyaya and Banerjee, PHI Pub., 2014

Physical Properties of Nanomaterials **(10 hours)**

Melting point and lattice constants, mechanical properties, optical properties-Surface Plasmon resonance, electrical conductivity-surface scattering-change of electronic structure-quantum transport-effect of microstructure, superparamagnetism.

Text Book: Nanostructures and Nanomaterials, G. Cao, Imperial College Press Pub., 2004

Module III

Carbon Nanostructures **(12 hours)**

Carbon Molecules -Nature of the Carbon Bond -New Carbon Structures-Carbon Clusters -Small Carbon Clusters -Carbon Nanotubes -Fabrication -Structure –Electrical Properties-Vibrational Properties-Mechanical Properties -Applications of Carbon Nanotubes -Computers -Fuel Cells -Chemical Sensors-Catalysis –Mechanical Reinforcement -Field Emission and Shielding.

Quantum Wells, Wires, and Dots **(12 hours)**

Preparation of Quantum Nanostructures -Size and Dimensionality Effects –Size Effects -Potential Wells-Partial Confinement -Conduction Electrons and Dimensionality -Fermi Gas and Density of States-properties Dependent on Density of States -Excitons -Single-Electron Tunneling.

Text Book: Introduction to Nanotechnology, Charles P. Poole, Jr. and Frank J. Owens, Wiley, 2003 Chapter 5 & 9

Module IV

Special Nanomaterials. **(10 hours)**

Porous Silicon - Aerogels – Zeolites- Ordered Porous Materials Using Micelles as Templates - Core-Shell Particles – Metamaterials, Applications.

Text Book: Nanotechnology: Principles and Practices, Sulabha K Kulkarni, Chapters 10 & 11

Applications of Nanomaterials **(10 hours)**

Introduction, nanomaterials in medicine, energy sector, computer technology, catalysis, water purification, communication, food - fabric industry, environment, automobiles, ceramic industry, veterinary applications

References:

1. Text Book of Nanoscience and Nanotechnology, BS Murthy, P Shankar, Baldev Raj, BB Rath and J Murday, University Press.
2. Introduction to Nanotechnology, Charles P. Poole, Jr. and Frank J. Owens, Wiley, 2003.

3. Nano: the essentials, T. Pradeep, TMH, 2007.
4. Nanoscale Materials, Luis M. Liz-Marzan and Prashant V. Kamat, Kluwer Academic Publishers, 2003.

Semester- 6

Choice Based Core Course – II **Credit-3 (72 hours)**

PH6CBT02: RENEWABLE ENERGY

Module I **(20 hours)**

Solar Energy and Solar Radiation

Solar constant – solar radiation at the earth's surface -instruments for measuring solar radiation and sunshine

Solar Thermal Energy

Devices for thermal collection and storage (flat plate collectors, concentrating collectors), Solar pond - thermal applications, water heating, power generation, distillation, drying and cooking, solar space heating

Text Book: Non-Conventional Energy Sources, G.D. Rai, Chapters- 3, 4 & 5

Module II **(20 hours)**

Wind Energy – Basic Components of a Wind Energy Conversion System – Site selection considerations - Applications of wind energy – Environmental Aspects

Energy from Biomass – Biomass conversion technologies – Energy plantation –Methods of obtaining energy from biomass - Classification of Biogas plants –Thermal gasification of biomass.

Geothermal Energy – Nature of Geothermal fields –Geothermal resources – Hot dry rock resources – magma resources – Geothermal exploration - Advantages and Disadvantages – Applications – Operational and environmental problems

Text Book: Non-Conventional Energy Sources, G.D. Rai, Chapters- 6, 7 and 8

Module III **(20 hours)**

Ocean Thermal Energy Conversion (OTEC) – Introduction – Open cycle OTEC system – Closed Cycle OTEC system – Hybrid Cycle

Energy from Tides – Basic principles of Tidal power – Components of Tidal power plant- Operation methods of utilization of tidal energy - Single cycle and double cycle systems – advantages and limitations of tidal power

Hydrogen Energy – Hydrogen production (Electrolysis, thermochemical methods) –Hydrogen storage – hydrogen as an alternative fuel for motor vehicles.

Text Books:

1. ***Non-Conventional Energy Sources, G.D. Rai,Khanna Publishers***
2. ***Solar Energy – Principles of Thermal Collection and Storage, S.P. Sukhatme***

Module IV

Energy Storage **(12 hours)**

Fuel cells – Design and principle of operation of a fuel cell – Classification of fuel cells – Conversion efficiency of fuel cells – Applications of fuel cells.

Hydrogen Energy – Hydrogen production (Electrolysis, thermochemical methods) – Hydrogen storage – hydrogen as an alternative fuel for motor vehicles.

Text Book: Non-Conventional Sources of Energy, G D Rai Chapter-10, 11

References:

1. Solar energy fundamentals and applications, H P Garg and J Prakash, TMH
2. Non Conventional energy resources, Shobh Nath Singh, Pearson
3. Solar energy fundamentals design modeling and applications, G N Tiwari, Narosa.
4. Renewable energy sources and their environmental impacts,SA Abbasi and N Abbasi, PHI.
5. Non conventional energy resources, J P Nani and Lond Sapra, S Chand.
6. Non conventional energy resources and utilization, R K Rajput, S Chand.
7. Fundamental of renewable energy systems, D Mukhergee, New Age.

Semester 6

Choice Based Core Course – III **Credit-3 (72 hours)**

PH6CBT03: ASTRONOMY AND ASTROPHYSICS

Module I

Observational Astronomy **(20 Hours)**

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

Optical Telescopes. Types of telescopes-refracting and reflecting – Newtonian and Cassegrain telescopes. Magnification and f number. Resolving Power, Telescope mounts – alt-azimuth and equatorial mounts. Telescope enhancements (CCD, Spectrograph). Hubble telescope, Telescopes of the future. Advent of radio astronomy- radio telescopes.

Module II

Celestial Sphere **(12 Hours)**

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

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

Sun **(8 Hours)**

Sun - solar atmosphere and internal structure – Photosphere, chromospheres and corona. Radiation zone & Convection Zone. Sun spots, Activity Cycles, flares, prominences, coronal holes, Solar wind.

Galaxies

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

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 & Tolman-Volkof limit, Supernovae, Pulsars, Black holes. Stellar Classification, H-R diagram - Main sequence stars

Module IV

Cosmology **(18 hours)**

Large scale structure of the universe – isotropy and homogeneity. Cosmological principle. Standard big bang model - GUT, Planck Epoch, Inflation, Nucleosynthesis, Recombination & CMBR. Expanding universe - red shift. Hubble's law and Hubble parameter. Age of universe and its determination. Dark energy and Dark Matter (qualitative idea).

Text Books:

1. ***Astrophysics: Stars and Galaxies, K D Abhyankar***
2. ***Astronomy, A Self-Teaching Guide, Dinah L. Moché,***
3. ***Introduction to Astronomy and Cosmology, Ian Morison***

References:

1. Introduction to cosmology, J V Narlikar, Cambridge University Press
2. A short history of the Universe, Joseph Silk, Cambridge University Press
3. http://www.astro.cornell.edu/academics/courses/astro201/topics.html
4. http://www.ualberta.ca/~pogosyan/teaching/ASTRO_122/lectures/lectures.html
5. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

SYLLABUS FOR PRACTICAL – CORE COURSES

A minimum of 8 experiments should be done in each practical course

SEMESTER 1

Course : PH1CRP01

1. Vernier Calipers - Volume of a cylinder, sphere and a hollow cylinder
2. Screw gauge - Volume of a sphere and a glass plate
3. Spherometer - Thickness of a glass plate, radius of curvature of a convex surface and a concave surface
4. Beam balance - Mass of a solid (sensibility method), radius measurement of capillary tube using mercury
5. Travelling microscope - Radius of a capillary tube
6. Multimeter - familiarization of measurements (resistance, potential difference, current) and checking of electronic components.
7. Surface tension - Capillary rise method
8. Hare's apparatus - comparison of liquid densities
9. Viscosity of a liquid -Variable pressure head
10. Spectrometer - Angle of prism

SEMESTER 2

Course : PH2CRP02

1. Cantilever- pin & microscope –Determination of Young's modulus
2. Carey Foster's Bridge-Measurement of resistivity
3. Symmetric Compound Pendulum-Determination of radius of gyration (K) and Acceleration due to gravity (g)
4. Familiarization of CRO – measurement of amplitude, time period and frequency of different wave forms
5. Half wave rectifier with and without filter-ripple factor and load regulation
6. Conversion of Galvanometer into voltmeter
7. Viscosity-constant pressure head- coefficient of viscosity (η) of the liquid
8. Spectrometer- Refractive Index of material of Prism
9. Field along the axis of a coil-Variation of magnetic field along the axis of a circular coil

10. Electro chemical equivalent of copper.

SEMESTER 3

Course: PH3CRP03

1. Cantilever – Scale and Telescope-Determination of Young's modulus
2. Carey Foster's Bridge-Temperature coefficient
3. Asymmetric Compound Pendulum-Determination of K and g
4. Spectrometer-refractive index of a liquid –Hollow prism
5. Diode Characteristics.
6. Potentiometer-Measurement of resistivity
7. Full wave rectifier using diode – Ripple factor and load regulation
8. Transistor characteristics- CE configuration
9. Gates AND, OR, NOT- Verification of Truth Table
10. Torsion pendulum - Rigidity modulus

SEMESTER 4

Course PH4CRP04

1. Non-uniform bending- Pin and Microscope method
2. Thermal conductivity of bad conductor- Lee's Disc
3. Bridge rectifier with filter and without filter- Ripple factor and load regulation
4. Spectrometer-prism- i-d curve
5. Potentiometer-Calibration of low range voltmeter
6. Searle's Vibration Magnetometer-Magnetic moment
7. Verification of superposition and maximum power transfer theorems
8. Diode clamper- Positive and negative
9. I - V characteristics of LED
10. Sweep generator using transistor

SEMESTER 5

Course : PH5CRP05

1. Fly Wheel – Moment of Inertia
2. Uniform bending – Young's Modulus-Optic lever method
3. Static torsion- Rigidity modulus
4. Viscosity- Stoke's method
5. Planck's constant using LED's of four different colours
6. Thermal conductivity of rubber
7. Melde's String – Measurement frequency
8. Sonometer – Verification of laws, Measurement of density of solid.
9. Potentiometer-Calibration of high range voltmeter.
10. Liquid Lens- Refractive index of Liquid

SEMESTER 5

Course : PH5CRP06

1. Spectrometer – Grating- wave length
2. Spectrometer- prism-Dispersive power
3. Liquid lens-Optical constants of a convex lens
4. Air wedge-Diameter of wire
5. Potentiometer-Calibration of low range ammeter
6. A.C Sonometer- Frequency of a.c.
7. Conversion of Galvanometer into ammeter
8. LCR circuit analysis-Series, parallel and Q-factor
9. Mirror Galvanometer-Figure of merit
10. B.G - charge sensitivity – Standard capacitor method

SEMESTER 5

Course : PH5CRP07

1. Characteristics of Zener diode
2. Voltage regulation using Zener diode
3. Voltage multiplier- Doubler and Tripler.
4. Characteristics of FET
5. Regulated power supply using IC 741
6. Wave shaping R C circuits - Integrator and differentiator
7. Diode clipper- Positive, Negative and Biased
8. Hartley Oscillator
9. De Morgans Theorem-Verification using basic gates (IC 7400 and 7402)
10. Phase shift oscillator

SEMESTER 5

Course : PH5CRP08

1. Spectrometer – Grating- dispersive power
2. Spectrometer – Cauchy's constants
3. Newton's rings- Determination of wave length.
4. Laser- Determination of wave length
5. Ultrasonic- Determination of velocity of ultrasonic waves
6. Single slit – Diffraction using Laser
7. Verification of Thevenin's and Norton's theorem
8. Deflection and Vibration Magnetometer- m & Bh

9. e/m – Thomson's apparatus- Bar magnet/magnetic focusing
10. B.G - Measurement of capacitance

SEMESTER 6

Course : PH6CRP09

1. Young's Modulus –Koenig's method
2. Torsion pendulum- n and I - using two identical masses
3. Spectrometer- Small angled prism-Refractive index of material of prism (Supplementary angle method)
4. Field along the axis of circular coil-Moment of magnet (null method)
5. Kater's pendulum-g
6. Study of solar cell characteristics
7. Sp.heat of liquid –Newton's law of cooling
8. Computer programming – Simple Pendulum –Calculation of 'g' from experimental data.
9. Computer programming – Solving differential equation – Rungekutta method – II order.
10. Computer programming – Euler's method

SEMESTER 6

Course : PH6CRP10

1. Universal gates IC – NAND, NOR-Realize basic gates from universal gates.
2. B.G. –Measurement of high resistance by leakage method
3. BCD to 7 segment decoder (IC)
4. Astable multivibrator – using transistor
5. Monostable multivibrator- using transistor
6. Monostable multivibrator – IC 555

7. 8085 Microprocessor – sorting in ascending and descending order.
8. Computer programming –Conversion of temperature scale
9. Computer programming –sorting the numbers in ascending and descending order C++
10. Computer programming – Solving a quadratic equation

SEMESTER 6

Course : PH6CRP11

1. Thermistor – Temperature coefficient of resistance
2. Regulated power supply – Transistor and Zener diode
3. Regulated power supply – Using IC's- LM 7805/7905/7809/7909/7812/7912
4. Construction and measurement of a dual Regulated power supply with filter.
5. Op-Amp - Adder and Subtractor
6. R.C. Coupled amplifier - Gain
7. Amplitude modulation
8. Pulse width modulation
9. Ring counter using 74194 and 74151
10. Astable multivibrator – IC 555

SEMESTER 6

Course : PH6CRP12

1. D/A Converter using IC
2. 4 bit Shift register
3. Flip-Flop – R.S
4. J.K Flip-Flop

5. Schmitt trigger using 7414
6. Op- Amp – Inverter, non inverter and buffer.
7. 8085 Microprocessor - BCD addition and subtraction
8. 8085 Microprocessor – multiplication of two eight bit numbers with result 16 bit.
9. Computer programming – Solving a linear equation- Bisection method.
10. Computer programming – Solving a equation by Newton – Raphson method
11. Computer programming- Generation of Fibonacci series

References:

1. Properties of Matter, D.S. Mathur
2. Optics, Subramanyan & 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.

SYLLABUS FOR COMPLEMENTARY PHYSICS FOR B.Sc MATHEMATICS AND CHEMISTRY

Semester 1

Complementary Course-1 **36 hours (Credit – 2)**

PH1CMT01: PROPERTIES OF MATTER, MECHANICS AND WAVES

Module I

Elasticity **(12 hours)**

Stress- strain- Hooke's law- Elastic moduli - work done per unit volume in a strain-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 & Properties of Matter, Dr. Anand V Karthik, P. Vivekanandan, Mahatma Gandhi University, Kottayam, Chapter 4

Module II

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.

Text Book: Mechanics & Properties of Matter, Dr. Anand V Karthik, P. Vivekanandan, Mahatma Gandhi University, Kottayam, Chapter 2

Module III

Oscillations **(10 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 oscillator- forced oscillator and resonance.

Text Book: Mechanics & Properties of Matter, Dr. Anand V Karthik, P. Vivekanandan, Mahatma Gandhi University, Kottayam, Chapter 3

Module IV

Waves **(4 hours)**

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

Text Book: Mechanics & Properties of Matter, Dr. Anand V Karthik, P. Vivekanandan, Mahatma Gandhi University, Kottayam, Chapter 6Mechanics, D S Mathur, Chapter 3

References:

1. Mechanics by J.C. Upadhayaya, Ramprasad publications
2. Properties of Matter, Brij Lal and Subrahmanyam.
3. Properties of Matter and Acoustics by Murugeshan and K. Sivaprasath, S. Chand
4. Mechanics by Hans and Puri, TMH
5. Mechanics by D.S. Mathur and P.S. Hemne, S. Chand.
6. Elements of Properties of Matter, D S Mathur
7. Properties of Matter by Mathur, S. Chand.Mechanics by Somnath Datta, Pearson.

Semester 2

Complementary Course-2 **36 hours (Credit – 2)**

PH2CMT02: THERMODYNAMICS, FLUID DYNAMICS, ELECTRIC AND MAGNETIC PHENOMENA

Module I

Thermodynamics **(12 hours)**

Thermodynamic system- closed and open systems- thermodynamic equilibrium- Zeroth law of thermodynamics and concept of temperature- isothermal process and adiabatic process- first law of thermodynamics-work done during isothermal and adiabatic process- Reversible and Irreversible process-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, S. Chand &Co, Chapter 4, 5&6

Module II

Surface tension **(4 hours)**

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

Text Book: Mechanics & Properties of Matter, Dr. Anand V Karthik, P. Vivekanandan, Mahatma Gandhi University, Kottayam, Chapter 5

Viscosity **(6 hours)**

Streamline and turbulent flow - critical velocity - Coefficient of viscosity - Derivation of Poiseuille's equation, stokes equation-Determination of viscosity by Poiseuille's method and stokes method.

Text Book: Mechanics & Properties of Matter, Dr. Anand V Karthik, P. Vivekanandan, Mahatma Gandhi University, Kottayam, Chapter 6

Module III

Magnetic Materials **(7 hours)**

Magnetization in materials – linear and non linear materials – diamagnetism- paramagnetism- ferromagnetism– hysteresis-ferromagnetic domains-anti-ferromagnetism - ferrimagnetism.

Text Books:

1. ***Solid State Physics, R. K. Puri and V.K. Babbar , S. Chand and Co.Chapter 8***
2. ***Solid State Physics, S. O. Pillai , Fourth Edition, New Age International Publishers, Chapter 9***

Module IV

Dielectric Materials **(7 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 Books*:**

1. ***Solid State Physics, S. O. Pillai , Fourth Edition, New Age International Publishers, Chapter 11***
2. ***Solid State Physics, R. K. Puri and V.K. Babbar ,S. Chand and Co. Chapter 9***

References:

1. Concepts of Modern Physics, A. Beiser, Tata McGraw-Hill, 5th Edn.
2. Modern Physics, R. Murugeshan, S. Chand and Co.
3. Introduction of Electrodynamics, D.J. Griffiths, PHI Pvt. Ltd
4. Modern Physics, G.Aruldas and P.Rajagopal, PHI Pub
5. Thermodynamics, Zemansky and Dittmann, Tata McGraw-Hill

Semester 3

Complementary Course-3 **54 hours (Credit – 3)**

PH3CMT03: ELEMENTS OF MODERN PHYSICS AND ELECTRONICS

Module I **(12 hours)**

Atomic Nucleus, Radioactivity

Classification of nuclei-General properties of nucleus-binding energy - packing fraction-nuclear stability-nuclear forces and its salient features-radioactivity-radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium- radioactivity units-Carbon dating-Artificial radioactivity.

Nuclear Fission and Fusion **(7 hours)**

Nuclear fission and fusion-Energy release in fission-Nuclear reactor-Atom bomb-Nuclear fusion-Energy production in stars-Thermo nuclear reactions in sun.

Text Book: Modern Physics, R. Murugeshan , S. Chand and Co., Chapter 27, 31, 34 & 35

Module II

Elementary Quantum Theory **(12 hours)**

Introduction- black body radiation and Planck's quantum hypothesis-photoelectric effect-de Broglie hypothesis- matter wave- Davisson-Germer experiment- uncertainty principle (derivation not expected) -wave function- conditions-normalization- Time Dependent and Independent Schrodinger equation.

Text Books:

1. ***Quantum Mechanics, G.Aruldhas , Second Edition, PHI, Chapter1&2***

2. Basic Quantum Physics, Ajoy Ghatak Chapter 1,2&3

Module III

Basic Electronics **(14 hours)**

PN junction diode-Forward and reverse bias-Current-voltage characteristics of a diode -breakdown mechanism of p-n junction diode-Zener diode and its characteristics-Zener

as as a voltage regulator-Diode Circuits:- Rectification- half wave and full wave rectifiers-bridge rectifier -ripple factor, efficiency-transistors- different transistor configurations- characteristics of different transistor configurations- voltage divider bias.

Text Books:

1. ***Principles of Electronics, V K Mehta, Chapters 9, 10, & 11***
2. ***Basic Electronics, B. L.Theraja , S. Chand and Co., Chapters 13, 15, 17, 19 & 20***

Module IV

Digital Electronics **(9 hours)**

Different number systems: – decimal, binary, octal, hexa decimal number systems- conversion between different number systems- binary addition and subtraction- basic theorems of Boolean algebra- de Morgan's theorems.

Logic Gates

AND, OR, NOT, NAND, NOR, XOR gates- truth tables- half adder- full adder

Text Book: Basic electronics, B. L. Theraja , S. Chand and Co., Chapters- 32, 33 &34

References:

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. Quantum Physics, S. Gasiorowicz , John Wiley & Sons
4. Elements of electronics, M.K. Bagde, S.P. Sngh and K. Singh, S. Chand and Co.
5. Modern Physics, G.Aruldas and P.Rajagopal, PHI Pub
6. Digital principles and applications, A. P. Malvino and P.Leach.

Semester 4

Complementary Course-4 **54 hours (Credit – 3)**

PH4CMT04: OPTICS AND SUPERCONDUCTIVITY

Module I

Interference **(12 hours)**

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.

Diffraction **(8 hours)**

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) – dispersive power

Text book: A Text Book of Optics, N. Subrahmanyam, Brijlal and M.N.Avadhanulu S. Chand and Co. Chapter 14 ,15,17 ,18 &19

Module II

Polarization **(15 hours)**

Introduction- polarized and unpolarized light- plane of vibration –plane of polarization - polarization by reflection- Brewster's law- polarization by refraction through pile of plates – law of Malus- uni-axial and biaxial crystals –principal plane- polarization by double refraction- polarization by selective absorption- polaroid- polarization by scattering- elliptically and circularly polarized light- half wave and quarter wave plates

Text Book: A text book of Optics, N. Subrahmanyam, Brijlal and M.N.Avadhanulu, S. Chand and Co., Chapter 20

Module III

Laser Physics **(13 hours)**

Interaction of electromagnetic radiation with matter- stimulated absorption- spontaneous emission- stimulated emission- principle of laser-population inversion- Einstein's coefficients- Types of lasers- Ruby laser - Properties of laser beams- Application of laser beams.

Text Books:

1. ***Modern Physics, R. Murugeshan, S. Chand and Co., Chapter 19***
2. **A text book of Optics,** ***N. Subrahmanyam, Brijlal and M.N.Avadhanulu, S. Chand and Co., Chapter 22***

Raman Effect

Rayleigh scattering-Raman effect-Experimental study of Raman effect-Quantum theory of Raman effect-Applications.

Text Book: Modern Physics, R. Murugeshan, S. Chand and Co., Chapter 23

Module IV

Superconductivity **(6 hours)**

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

Text Book*: *Solid State Physics S. O. Pillai Fourth Edition, New Age International Publishers, Chapter 8

References:

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. Modern Physics, R. Murugeshan, S. Chand and Co.
4. Modern Physics, G.Aruldas and P.Rajagopal, PHI Pub
5. Solid State Physics, R. K. Puri and V.K. Babbar, S. Chand and Co.

SYLLABUS FOR PRACTICAL

COMPLEMENTARY PHYSICS FOR MATHEMATICS AND CHEMISTRY

A minimum of 8 experiments should be done in each practical course

SEMESTER I

PH1CMP01- PRACTICAL I

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
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

SEMESTER 2

PH2CMP02- PRACTICAL II

1. Cantilever – Scale and Telescope-Determination of Young's modulus
2. Asymmetric Compound Pendulum-Determination of K and g
3. Coefficient of Viscosity – Constant pressure head
4. Liquid lens - Refractive Index of glass using liquid of known refractive index
5. Potentiometer- Measurement of resistance
6. Characteristics of Zener diode
7. Construction of half wave rectifier with and without filter – Ripple factor
8. Torsion pendulum - Rigidity modulus
9. Spectrometer – Refractive Index of the material of the Prism
10. I-V characteristics of LED

SEMESTER 3

PH3CMP03- PRACTICAL III

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 BH
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. Potentiometer-Calibration of low range ammeter
8. Construction of full wave rectifier with and without filter – Ripple factor
9. Construction of regulated power supply using Zener diode
10. Spring Constant – Hooke's Law.

SEMESTER 4

PH4CMP04- PRACTICAL IV

1. Uniform bending –Young's modulus- Optic lever method
2. Torsion pendulum (Equal mass method) - Rigidity modulus and Moment of Inertia
3. Fly wheel - Moment of Inertia
4. Static Torsion - Rigidity modulus
5. Spectrometer - Grating Dispersive power
6. Newton's rings - Wave length
7. Deflection and Vibration Magnetometer- m & Bh
8. Conversion of Galvanometer into voltmeter
9. Gates – AND, OR, NOT- verification of truth table
10. Potentiometer - Calibration of low range voltmeter

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.
8. Practical Physics – C. L. Arora

MODEL QUESTION PAPERS

FIRST SEMESTER B Sc DEGREE (CBCS) EXAMINATION

PH1CRT01: UNDERSTANDING PHYSICS

For B Sc Physics (Model I)

Time: 3 hrs **Maximum: 60 Marks**

Part A (Very Short Answer Questions)

Answer **all** questions, **1** marks each.

1. What do you mean by unification of all force of nature?
2. What are absolute and relative errors?
3. Discuss the contribution of M.N Saha towards physics.
4. Write a note on passive and active sonars.
5. Discuss the working of ammeter.
6. Explain how repeated measurement tends to reduce errors.
7. What are the common errors in digital instruments?
8. What is a transducer?

(8x1=8)

Part B (Short Answer Questions)

Answer any **six** questions, Each carries **2** marks.

9. What are the key features of Quantum mechanics?
10. Discuss how spectrometer can be used for angle measurement.
11. Explain the significance of Kepler's law of planetary motion?
12. How can we measure stellar parallax?
13. Discuss the importance of estimating error.
14. What are the important parameter affect the measurement electrical transducer.

15. What do you mean by standard deviation? How can this be used in error reporting?
16. What is the difference between active and passive transducer.
17. What are the advantage and disadvantage of resistive transducer?
18. Briefly explain classification of errors.

(6x2=12)

Part C (Problems/ Derivations/ Short Essays)

Answer any **four** questions, Each carries **4** marks

19. Explain how Maxwell unified electricity Magnetism and optics?
20. Explain the working principle of a travelling microscope.
21. The following readings were obtained when a resistance was measured 1.34Ω, 1.38Ω, 1.56Ω, 1.47Ω, 1.42Ω, 1.44Ω, 1.53Ω, 148Ω, 1.40Ω and 1.59Ω. Assuming that only random errors are present calculate the following,
    a) Arithmetic Mean
    b) Average Deviation
    c) Standard Deviation
22. With the help of quantum theory write a short note on Raman effect.
23. Explain the working principle of thermistor.
24. With neat sketches describe the error bars and their important parameters.

(4x4=16)

Part D (Essays)

Answer **any two** questions, Each question carries **12** marks

25. Discuss the contributions of Newton and Einstein to the physics.
26. Explain different methods for measurement of length.
27. Briefly explain the different types of strain gauges.
28. a) Discuss the propagation of errors.
    b) Discuss the needs and methods for calibration.

(2x12=24)

SECOND SEMESTER B Sc DEGREE (CBCS) EXAMINATION

PH2CRT02: BASIC MECHANICS AND PROPERTIES OF MATTER

For B Sc Physics (Model I)

Time: 3 hours **Maximum Marks: 60**

Part A (Very Short Answer Questions)

Answer **all** questions, **1** marks each.

1. Define Poisson's ratio.
2. Explain **I** – section of girders.
3. What is Q-factor?
4. Obtain the relation connecting torque and angular momentum.
5. State Parallel axis theorem.
6. Obtain the differential equation for simple harmonic motion.
7. Define surface tension and surface energy.
8. Distinguish between steady flow and turbulent flow.

(8 x 1 = 8)

Part B (Short Answer Questions)

Answer any **six** questions, Each carries **2** marks.

9. Describe all three modulus of elasticity.
10. What is a beam? What is neutral surface?
11. Derive the expression for torsional potential energy.
12. Write a note on lubricants.
13. Mention any four applications of surface tension.
14. What is resonance? Explain sharpness of resonance?
15. Show that the velocity of a damped harmonic oscillator decreases exponentially with time.
16. Derive an expression for the M.I of a disc about its tangent.
17. State and prove law of conservation of angular momentum.
18. The mass of a flywheel is concentrated at its rim. Why?

(6 x 2 = 12)

Part C (Problems/ Derivations/ Short Essays)

Answer any **four** questions, Each carries **4** marks

19. Four spheres of diameter 0.02 m and mass 0.01 kg each are placed with their centers at the four corners of a square of side0.01m. Calculate the M.I of the system about one side of the square.
20. A flywheel of radius 10 cm is mounted so as to rotate about a horizontal axis through its centre. A string of negligible mass wrapped round its circumference carries a mass of 200 g attached to its free end, when let fall the mass descends through 100 cm is 5 s. Calculate the angular acceleration and the moment of inertia of the flywheel.
21. The damping force acting on a particle of mass 4 g moving with velocity 10 ms^{-1} brings it to rest in a distance of 50 m. Calculate (i) the relaxation time, (ii) the time in whichits velocity is halved, (iii) the damping force when the velocity is 3 ms^{-1}.
22. Calculate the work done in twisting a steel wire of radius 0.001m and length 0.25 m through an angle of 45 degree. Given rigidity modulus = 8 x 10^{10} Nm^{-2}.
23. Water flows through a horizontal tube of length 0.2 m and internal radius 8.1 x 10^{-4} m^3 under a constant head of the liquid 0.2 m high. In 12 min 8.64 x 10^{-3} m^3 of liquid is coming out of the tube. Calculate the coefficient of viscosity. Density of liquid is 10^3 kgm^{-3}.
24. A cantilever of length 60 cm is depressed by 20 mm at the loaded end. What is the depression at a distance 40 cm from the fixed end?

(4 x 4 = 16)

Part D (Essays)

Answer **any two** questions, Each question carries **12** marks

25. Derive an expression for the M.I of a solid cylinder about an axis passing through its centre and perpendicular to its length.

26. Explain damped harmonic motion. Obtain the differential equation for damped harmonic oscillation.

    Discuss the solution and explain the terms (i) under damped,(ii) over damped and (iii) critically damped motions.

27. Describe with necessary theory, the method of determining the rigidity modulus of the material of a wire by torsion pendulum.

28. Derive Poiseuille's formula for the flow of a liquid through a pipe. Mention the corrections to be applied to the formula.

(2x12 = 24)

THIRD SEMESTER B Sc DEGREE (CBCS) EXAMINATION

PH3CRT03: ELECTRONICS

For B Sc Physics (Model I)

Time: 3 hours **Maximum Marks: 60**

Part A (Very Short Answer Questions)

Answer **all** questions, **1** marks each.

1. Distinguish between static and dynamic resistance of a diode.
2. Why are filter circuits used in power supply?
3. The output resistance of a transistor in CB configuration is very high. Why?
4. Draw and label the schematic diagram of N-channel and P-channel FET.
5. Distinguish between oscillators and amplifiers.
6. What are the advantages of negative feedback?
7. What do you mean by CMRR of an op-amp?
8. List some major applications of an op-amp. **(8 x 1 = 8)**

Part B (Short Answer Questions)

Answer any **six** questions, Each carries **2** marks.

9. Define efficiency and ripple factor of a rectifier. Write down their values for (i) half wave rectifier and (ii) full wave rectifier.
10. What are clamping circuits?
11. What are voltage regulators? Explain the action of a Zener diode as a voltage regulator.
12. Arrive at arelation connecting current amplification factor in CB and CC configurations
13. What is midpoint biasing? State its important features.
14. What are FET parameters? How are they related?
15. How is a phase shift of 180^0 established in Phase shift oscillators?
16. What do you understand by negative feedback in amplifiers? Mention any three of its advantages.
17. What are the characteristics of an ideal op amp?
18. Differentiate a non-inverting op amp amplifier from an inverting op-amp amplifier.

(6 x 2 = 12)

Part C (Problems/ Derivations/ Short Essays)

Answer any **four** questions, Each carries **4** marks

19. Describe the working of a bridge rectifier.
20. Explain the working of a voltage tripler.
21. What do you mean by thermal stability? How is it achieved in transistors?
22. In a voltage divider biased CE amplifier circuit with R_1 =100kΩ , R_2= 90 kΩ, V_{CC}= 22.5 V, R_C= 5.6 kΩ and β= 55, V_{BE}= 0.7V. Calculate the operating point; draw the d c load line and mark the operating point.
23. An amplifier has a voltage gain of 100. The feedback ratio is 0.05. Find (i) the voltage gain with feedback, (ii) the amount of feedback in dB. (iii) the output voltage of the feedback amplifier for an input voltage of 30mV.
24. A certain op amp has an open loop gain of 50000 and a common mode gain 0.25. Calculate its CMMR and express it in decibels.

(4 x 4 = 16)

Part D (Essays)

Answer **any two** questions, Each question carries **12** marks

25. What are clipping circuits? What are their applications? Discuss the working of positive, negative and biased clippers with proper circuit diagrams and input and output waveforms.
26. Why is biasing needed in a transistor? What is the drawback of the fixed current bias method?

    Explain with a neat diagram how this drawback is removed in the method 'base bias with emitter feedback'. Obtain an expression for collector current and saturated collector current of a transistor biased in this way.
27. With a neat diagram explain the working of a Hartley oscillator.
28. What is an OpAmp? Briefly explain the working principle of an Op amp. Describe the use of Op amp as an adder.

(2 x 12= 24)

FOURTH SEMESTER B Sc DEGREE (CBCS) EXAMINATION

PH4CRT04: ELECTRICITY, MAGNETISM AND ELECTRODYNAMICS

For B Sc Physics (Model I)

Time: 3 hours **Maximum Marks: 60**

Part A (Very Short Answer Questions)

Answer **all** questions, **1** marks each.

1. Write down Gauss's law in differential form.
2. Give the expression for the electric field due to appoint charge.
3. What is Lorentz force? Write down Lorentz relation.
4. Define Poynting's vector. Represent it mathematically.
5. State Ampere's law as modified by Maxwell
6. What is meant by time constant in an L-R circuit?
7. State Thevenin's theorem
8. Write down the expression for power in an LCR circuit.

(8 x 1 = 8)

Part B (Short Answer Questions)

Answer any **six** questions, Each carries **2** marks.

9. State maximum power transfer theorem and discuss its physical significance.
10. Show that energy of a continuous charge distribution is given by W = $\frac{\varepsilon_0}{2}\int E^2 d\tau$

    $\frac{\varepsilon_0}{2}\int E^2 d\tau$
11. Explain with a graph, how electric field intensity due to a uniformly charged spherical.
12. Explain vector potential. How is it related to magnetic flux density.
13. Calculate the energy per unit volume stored in an electromagnetic field.
14. What is displacement current? Explain its significance.
15. What is an ideal current source?
16. Using Maxwell's equations, show that the velocity of electromagnetic waves through vacuum is 3 x 10^8 m/s.
17. Define form factor. What is its value in the case of a sinusoidal voltage?

18. State and explain Biot-Savart law.

(6 x 2 = 12)

Part C (Problems/ Derivations/ Short Essays)

Answer any **four** questions, Each carries **4** marks

19. A coil of self inductance 2 milli Henri and resistance 15 ohm is connected in parallel with a capacitance of 0.001μF. Find (i) the frequency at which the current from an ac source to this circuit is minimum, (ii) the peak value of this make up current if the peak value of the supply voltage is 2V.
20. Find the current through 1.5 Ω resistor using Thevenin's theorem.
21. A solenoid of 1200 turns is wound uniformly in a single layer on a glass tube 2 m long and 0.02 m in diameter. Find the magnetic flux density (a) at the centre of the solenoid (b) at the ends when a current 2 A flows through it.
22. Find the magnitude and direction of electric field at a point midway between two opposite charge of magnitude 5 x 10^{-3} C placed 20 cm apart. Also find the magnitude and direction of the electrostatic force exerted on an electron of charge 1.6 x 10^{-19} C placed at that point.
23. Three point charges +2, +4 and -5 microcoulombs are placed respectively at the vertices A, B and C of an equilateral triangle of side 0.2 m. Find the magnitude of the force experienced by the charge at C.
24. Establish from Biot-Savart's law $\nabla .B = 0$.

(4 x 4 = 16)

Part D (Essays)

Answer **any two** questions, Each question carries **12** marks

25. (i) State Ampere's circuit law and obtain the magnetic field due to an infinitely long coaxial line.

    (ii) Define magnetic scalar and vector potential. Mention their significances.
26. Discuss the decay of charge in an LCR circuit and analyze different cases.
27. (i) State and prove Gauss's law.

    (ii) Derive Laplace and Poisson's equations.
28. Give an account of Maxwell's equations in free space. Solve the equations and determine the velocity of light vacuum. **(2x12 = 24)**

FIFTH SEMESTER B Sc. DEGREE (CBCS) EXAMINATION
PH5CRT05: CLASSICAL AND MODERN OPTICS
For B Sc Physics (Model I)

Time: 3 hour **Maximum: 60 Marks**

Part A (Very **Short Answer Questions**)

Answer **all** questions, **1** marks each.

1. Distinguish between Haidinger fringes and fringes of equal thickness
2. Why do thin transparent films appear brilliantly colored when viewed in sunlight?
3. The function of a zone plate is similar to that of a ----------
4. How can coherent sources be obtained in practice?
5. State Brewster's law
6. Distinguish between polarized and unpolarized light
7. What is population inversion?
8. What is meant by specific rotation?

(8 x 1 = 8)

Part B (Short **Answer Questions**)

Answer any **six** questions, Each carries **2** marks.

9. Briefly explain how Huygens explained double refraction.
10. What is optical resonator?
11. What is holography? Mention some of the applications.
12. Explain the optic axis and principal section of a crystal.
13. Briefly explain the functioning of three level laser system.
14. What is meant by absent spectra?
15. Give the differences between a zone plate and a convex lens.
16. State the difference between reflected and transmitted systems of Newton's Rings.
17. Explain metastable state
18. Distinguish between Fresnel and Fraunhofer diffraction.

(6 x 2 = 12)

Part C (Problems/ Derivations/ Short Essays)

Answer any **four** questions, Each carries **4** marks

19. Calculate the least thickness of a calcite plate which would convert plane polarized light into circularly polarized light. Given $\mu_o = 1.658$, $\mu_e = 1.486$ and wavelength of light is 5890 Å.
20. Newton's rings are formed in reflected light using a plano convex lens of radius of curvature one metre and a plane glass plate. Find the radius of the 10^{th} dark ring if light of wavelength 590 nm is used.
21. For a sodium lamp, the distance moved by the moving mirror of Michelson interferometer is 0.289 nm for two distinct appearances for the fringe system. Calculate the difference in wavelength. Mean $\lambda = 589$ nm.
22. Find the ratio of populations of the two states in a He-Ne laser that produces light of wavelength 6320 Å at 30°C.
23. Explain the principle and working of Ruby laser.
24. The limits of the visible spectrum are approximately $4000A^0$ and $7000A^0$. Find the angular width of the first order spectrum by a grating having 5×10^6 lines per metre.

(4 x 4 = 16)

Part D (Essays)

Answer **any two** questions, Each question carries **12** marks

25. What are Einstein's coefficients? Show that the probabilities of stimulated emission and stimulated absorption are the same.
26. Discuss the phenomenon of Fraunhofer diffraction at a single slit.
27. Explain the formation of Newton's rings in reflected system. Briefly explain the experiment to determine the wavelength of a monochromatic source of light by Newton's rings method.
28. What is quarter wave plate? Explain its construction and use. How will you use it to produce elliptically and circularly polarised light?

(2x12 = 24)

FIFTH SEMESTER B Sc. DEGREE (CBCS) EXAMINATION

PH5CRT06: CLASSICAL MECHANICS AND RELATIVITY

For BSc Physics (Model I)

Time: 3 hours **Maximum Marks: 60**

Part A (Very Short Answer Questions)

Answer **all** questions, **1** marks each.

1. What are inertial frames of references?
2. When do you say a force is conservative?
3. Give the first integral of motion.
4. What is meant by reduced mass of the system?
5. What are constraints?
6. What is meant by degrees of freedom?
7. What is principle of equivalence?
8. Give the two postulates of special theory of relativity.

(8x1=8)

Part B (Short Answer Questions)

Answer any **six** questions, Each carries **2** marks.

9. Is the force **F=AxR** conservative?
10. "Law of conservation of linear momentum is a consequence of Newton's first law". Substantiate.
11. State and explain the analogue of Newton's second law in rotational motion.
12. What is a central force? Are all central forces conservative?
13. In case of inverse square law force field, if the orbit is circular prove that the potential energy is twice the total energy.
14. Explain D'Alembert's principle.
15. Briefly explain Hamiltonian of a system.
16. What is configuration space? Why does the path of motion in the configuration space not necessarily resemble the path in space of an actual particle?
17. Discuss time dilation.
18. Explain longitudinal and transverse Doppler effect in light. **(6x2=12)**

Part C (Problems/ Derivations/ Short Essays)

Answer any **four** questions, Each carries **4** marks

19. A mass m tied to a spring having a force constant k oscillates in one dimension. If the motion is subjected to the force F=-kx, find the expressions for displacement, velocity and period of oscillation.
20. The orbit of a particle of mass m moving in a central force is given by $r=k\theta^2$, where k is a constant. Find the law of force.
21. Mass m and 2m are connected by a light inextensible string which passes over a pulley of mass 2m and radius a. Write the Lagrangian and find the acceleration of the system.
22. Obtain Hamilton's equations for a simple pendulum. Hence obtain an expression for its period.
23. A stationary body explodes into two fragments each of mass 1.0kg that move apart at speeds 0.6c relative to the original body. Find the mass of the original body.
24. Derive the relativistic length contraction using the Lorentz transformation.

(4x4=16)

Part D (Essays)

Answer **any two,** Each question carries **12** marks

25. For a particle moving under the action of a force, prove that the sum of its kinetic energy and potential energy remains constant throughout its motion. Discuss on motion under constant and time dependent force.
26. Discuss on Kepler's law. Derive the expression for law of gravitation from Kepler's law.
27. Derive Lagrange's equations.
28. Derive Lorentz transformation equations starting from Galilean transformation.

(2x12=24)

FOURTH SEMESTER B Sc. DEGREE (CBCS) EXAMINATION
PH5CRT07: DIGITAL ELECTRONICS AND PROGRAMMING

Time: 3 hours **Maximum Marks: 60**

Part A (Very Short Answer Questions)

Answer **all** questions, **1** marks each.

1. Determine the octal equivalent of 253_{10}.
2. Add the binary numbers 11011 and 11101.
3. What is a Half-adder? Write its truth table.
4. Differentiate a multiplexer from a demultiplex
5. What is a D flip-flop?
6. What is a shift register? Name any two types of registers.
7. What is the Simpson's 1/3 rule for numerical integration?
8. What is a pre-processor directive in C++?

(8 x 1 = 8)

Part B (Short Answer Questions)

Answer any **six** questions, Each carries **2** marks.

9. Convert the binary number 1001001_2 into hexadecimal after converting into its decimal equivalent.
10. Multiply the following binary numbers 1011 and 1101.
11. Give the basic laws of Boolean algebra
12. Describe the working of a Full- subtractor.
13. With the aid of block diagram explain the function of an encoder.
14. Explain the working of 3 to 8 decoder.
15. Design an SR flip-flop using NOR gates.
16. Describe the syntax for a while loop.
17. Write an algorithm for second order Runge Kutta Method.
18. Distinguish between entry controlled loop and exit controlled loop.

(6 x 2 = 12)

Part C (Problems/ Derivations/ Short Essays)

Answer any **four** questions, Each carries **4** marks

19. State and prove De Morgan's therorems
20. Explain the working of full subtractor.
21. With the help of logic diagram, explain the working of decimal to BCD encoder.
22. What do you mean by race-around condition in flip-flops? Explain how it can be overcome?
23. Write an algorithm for Newton_Raphson Method.
24. Write a small program in C++ to print the squares of the numbers 0 to 10 using a for loop.

(4 x 4 = 16)

Part D (Essays)

Answer **any two** questions, Each carries **12** marks

25. Evaluate √12 to four places of decimal using Newton Raphson Method.
26. Design an AND-to-OR gate combinational network for the Boolean algebra expression

    ABCD+ABCD+ABCD+ABCD+ABCD+ABCD
27. Design a logic circuit for addition/subtraction, hence explain its working.
28. Describe the working of a ladder type D/A converter.

(2 x 12= 24)

FIFTH SEMESTER B Sc. DEGREE (CBCS) EXAMINATION

PH5CRT08: ENVIRONMENTAL PHYSICS AND HUMAN RIGHTS

For BSc Physics (Model I)

Time: 3 hours **Maximum Marks: 60**

Part A (Very Short Answer Questions)

Answer **all** questions. **1** marks each.

1. Briefly explain the reason why forest is considered a resource.
2. What is called hydro energy?
3. Illustrate a flat plate collector which taps solar energy.
4. Why is it said that Sun is the biggest source of energy for earth?
5. Explain thermal pollution. Mention any two ways in which thermal pollution could be prevented.
6. What is the aim of Forest Conservation Act legislated in India?
7. Mention various measures undertaken by UNO for the protection of Human rights.
8. State any two ways in which rights of religious, linguistic and cultural minorities are protected in India.

(8x1=8)

Part B (Short answer Questions)

Answer any **six** questions, Each carries **2** marks.

9. What are the various mineral resources available in India? How does the mineral resource enrich the economy of the country?
10. What is geothermal energy? How could geothermal energy be used as a sustainable energy resource?
11. Explain methods for tapping and effective utilization of wind energy.
12. Analyse the use of solar concentrators in delivering energy to households.
13. What are solar Green Houses? Briefly explain the advantages of Green Houses.
14. What are the hazards associated with excessive dependence on nuclear energy source?
15. Analyze the impacts felt in the society due to unscientific disposal of solid wastes.
16. Discuss various criteria of Environmental protection act.

17. What are Human Rights? How UDHR helps in the protection of human rights in the global platform?
18. Briefly explain National Human Rights Commission and its functions.

(6x2=12)

Part C (Problems/ Derivations/ Short Essays)

Answer any **four** questions, Each carries **4** marks

19. Briefly explain various sources of water available in nature. How do human activities degrade the water resources?
20. Discuss the demerits of non renewable energy sources.
21. What is a solar photovoltaic? Describe its working principle.
22. In what ways do the solid wastes from Industrial units impact ecological balance. Design suitable control measure to tackle the problem.
23. Elaborate on the concept of environmental ethics. Why is it said that protection of environment for the future generations is an obligation and moral responsibility of human beings?
24. Evaluate various measures through which the rights of the weaker sections, especially women, are guarded in the Indian society.

(4x4=16)

Part D (Essays)

Answer **any two** questions, Each question carries **12** marks

25. What are the various non renewable energy sources available on Earth? Briefly elaborate the merits of switching over to non renewable energy sources.
26. Discuss any five methods for the effective utilization of Solar Energy.
27. Explain the causes, consequences and control measures for various types of pollution occurring in the environment.
28. Elaborate on any three important legislative measures undertaken by India for preserving nature and controlling Environmental pollution.

(2x12=24)

FIFTH SEMESTER B Sc. DEGREE (CBCS) EXAMINATION

PH5OPT01: OPEN COURSE-PHYSICS IN DAILY LIFE

Time: 3 hours **Maximum Marks: 80**

Section A (Very Short Answer Questions)

*Answer **all** questions. **1** marks each.*

1. What are fundamental units?
2. State Newton's Law of gravitation.
3. Astronomers in orbiting satellites experience weightlessness. Why?
4. Explain the reason why sky appears blue during day time.
5. State ohm's law
6. Briefly describe the process of mirage formation.
7. What is surface tension?
8. Differentiate between transverse and longitudinal waves
9. What are constellations?
10. What are geostationary satellites?

(10x1=10)

PART B (Short Answer Questions)

*Answer any **eight** questions. Each carries **2** marks.*

11. Briefly explain the concept of inertia.
12. What is order of magnitude? Find the order of magnitude of following numbers

    (a) 10, (b) 20.5×10^7, (c) 500
13. Explain the law of conservation of momentum. What are its applications?
14. Differentiate mass, weight and apparent weight.
15. Explain the reason behind sparkling of rainbow.
16. Differentiate between fluorescence and phosphorescence
17. Describe hydroelectric power generation
18. What are primary and secondary rainbows?
19. Explain Bernoulli's theorem and its applications
20. What is Doppler Effect? Explain.
21. Write short note on GPS.

22. What is the difference between a natural satellite and an artificial satellite?

(8x2=16)

PART C (Problems/ Derivations/ Short Essays)

*Answer any **four** questions. Each carries **4** marks*

23. Compute the weight of a 80 kg space ranger (a) on Earth (b) on Mars, where g= 3.7 m/s^2, and (c) in interplanetary space, where g= 0.
24. Find the dimensional formal of the Universal constant of gravitation G.
25. A ball is thrown up at a speed of 4 m/s. Find the maximum height reached by the ball.
26. The refractive of glass is 1.5. Find the speed of light in glass.
27. A nearsighted man can clearly see objects up to a distance of 1.5 m. Calculate the power of the lens of the spectacles necessary for the remedy of this defect.
28. Calculate the heat produced by an electric iron which has a resistance of 30 ohms and takes a current of 3 Amperes when it is switched on for 15 seconds.
29. Convert 37^0 Celsius to Fahrenheit.
30. A sound detector is placed on a railway platform. A train approaching the platform at a speed of 36 km/hr sounds its whistle. The detector detects 12 kHz as the most dominant frequency in the whistle. If the train stops at the platform and sounds the whistle, what would be the most dominant frequency detected? (Speed of sound in air= 340 m/s)
31. Illustrate the different faces of moon in a lunar month.

(6x4=24)

Part D (Essays)

*Answer any **two** questions, Each question carries **15** marks*

32. State and explain Newton's three laws of motion. Derive
33. Illustrate the image formation in a human eye. What are the common types of diseases affecting human eye? How these defects are rectified using lens?
34. Explain the concepts of Heat energy and temperature. Briefly explain the different scales used to measure the temperature.

35. Elaborate on different types of celestial bodies such as planets, stars, constellations etc. observed in the sky during night.

(2x15=30)

SIXTH SEMESTER B Sc. DEGREE (CBCS) EXAMINATION

PH6CRT09: QUANTUM MECHANICS AND SPECTROSCOPY

For B Sc Physics (Model I)

Time: 3 hours **Maximum Marks: 60**

PART A (Very Short Answer Questions)

*Answer **all** questions. **1** marks each.*

1. Distinguish between group and phase velocity.
2. What is the condition for an operator to be Hermitian?
3. What is meant by stationary state?
4. Write down the orthogonality condition for eigenfunctions.
5. What is band spectrum?
6. Differentiate between Stoke's and antistoke's lines.
7. Give examples for continuous spectrum.
8. What are electronic band spectra?

(8 x 1 = 8)

PART B (Short Answer Questions)

*Answer any **six** questions. Each carries **2** marks*

9. What is de Broglie hypothesis? Give an expression for the de Broglie wavelength.
10. What do you mean by the expectation value of an observable? Give an expression for it.
11. Distinguish between commuting, anti-commuting and non-commuting operators.
12. Explain the term degeneracy of eigen states.
13. What do you mean by zero point energy of a harmonic oscillator?
14. Distinguish between Fluorescence and Phosphoresence.
15. Why classical theory of Raman effect fails?
16. What is anomalous Zeeman effect?
17. Give the different molecular energies.
18. State the postulates of Bohr atom model.

(6 x 2 = 12)

PART C (Problems/ Derivations/ Short Essays)

*Answer any **four** questions. Each carries **4** marks*

19. A particle is confined to a box of width 40 Å. Determine the probability that the particle is found in an interval of 4 Å at the centre of the box. Assume that the particle is in its lowest energy state.
20. If 1 and 2 are the two wave functions belonging to the same energy eigen value E1, show that their linear combination is also an eigen state having the same energy E1.
21. An electron has a speed of 500 m/s with an accuracy of 0.04 %. Calculate the certainty with which we can locate the position of the electron.
22. Calculate the Zeeman shift in the normal Zeeman effect when a spectral line of wavelength 6000 Å is subjected to a magnetic field of 0.5 Wbm^{-2}. e/m of electron = 1.76 x 10^{11} Ckg^{-1}.
23. The Raman spectrum of benzene showed lines corresponding to Raman shifts 608 and 846 cm^{-1}. What would be the Raman wavelength if benzene is exposed to light of wavelength 546.1 nm.
24. Calculate the vibrational energy levels of HCl molecule, assuming the force constant to be 516 Nm^{-1}.

(4 x 4 = 16)

PART D (Essays)

*Answer any **two** questions, Each question carries **12** marks*

25. Discuss the method of box normalization. Obtain the eigen values and normalized eigen functions of a particle confined to a one dimensional rectangular box.
26. Discuss the importance of a wave function in the quantum mechanics. Explain the probability interpretation and conditions on the wave function.
27. With principle and experimental set up explain Stern-Gerlach experiment and give its significance.
28. Obtain an expression for the rotational energy levels of a diatomic molecule taking it as a rigid rotator. Discuss its spectrum and selection rules.

(2x12 = 24)

SIXTH SEMESTER B Sc. DEGREE (CBCS) EXAMINATION

PH6CRT10: SOLID STATE PHYSICS

For B Sc Physics (Model I)

Time: 3 hours **Maximum Marks: 60**

PARTA (Very Short Answer Questions)

*Answer **all** questions. **1** marks each.*

1. What is packing efficiency?
2. Explain the term 'mobility of charge carriers'.
3. What are Bravais lattices?
4. Distinguish between intrinsic and extrinsic semiconductors.
5. State Curie law for paramagnetic substances.
6. What are the different sources of polarizability in dielectrics?
7. Discuss Josephson tunneling.
8. What is London penetration depth?

(8x1=8)

PART B (Short Answer Questions)

*Answer any **six** questions. Each carries **2** marks.*

9. What are SQUIDS? Discuss their working principle
10. What do you mean by a vortex state in type II superconductors?
11. Discuss the coercivity and retentivity in ferromagnetic materials.
12. Give an account of the temperature dependence of Fermi level in N type and P type material.
13. Explain the phenomenon of ferroelectricity? Name any two ferroelectric materials.
14. Discuss the effect of temperature on mobility of charge carriers.
15. What are ionic crystals? Give two examples.
16. Differentiate ferromagnetic and antiferromagnetic materials.
17. What is Madelung constant?
18. Distinguish between the close packed arrangements in fcc and hcp structures.

(6x2=12)

PART C (Problems/ Derivations/ Short Essays)

*Answer any **four** questions, Each carries **4** marks*

19. The lattice constant of a cubic crystal is 6.23 A°. What is the interplanar spacing between the (111) plane?
20. An electric field of 100 V/m is applied to a sample of n-type semiconductor whose Hall co-efficient is -0.0125m3/coulomb. Determine the current density. Given, the electron mobility is 0.36 m2/V-s.
21. In a Triclinic crystal, a cleavage plane makes intercepts 2.93, 4.7 and 2.37 units along the three crystallographic axes, the corresponding primitives being 3.05,6.99 and 4.9 A°. Deduce the Miller indices of the cleavage plane.
22. An iron rod of 0.5 cm2 area of cross section is subjected to a magnetising field of 1200 Am-1.If the susceptibility of iron is 599, Calculate (i) the permeability (ii) magnetic induction B in the specimen and (iii) magnetic flux produced.
23. The dielectric constant of a medium is 4. The electric field in the dielectric is 10^6 Vm-1.Calculate the electric displacement vector and polarization.
24. A superconducting material has a critical temperature of 3.7 K in the absence of a n external field and a critical field of 0.0306 Tesla at absolute Zero. Find the critical field of the material at 2 K.

(4x4=16)

PART D (Essays)

*Answer **any two** questions, Each question carries **12** marks*

25. What are cooper pairs? How do they account for superconductivity? Describe the BCS theory of superconductivity.
26. Obtain an expression relating electric field intensity, polarization vector and dielectric displacement vector of dielectric materials. Derive an expression connecting susceptibility and dielectric constant.
27. Discuss Hall Effect. Obtain an expression for the Hall voltage.
28. Derive Bragg's law of X-ray diffraction in crystals. Discuss the principle behind the different X-ray diffraction methods. (2x12=24)

SIXTH SEMESTER B Sc. DEGREE (CBCS) EXAMINATION

PH6CRT11: NUCLEAR PHYSICS AND PARTICLE PHYSICS, ASTROPHYSICS

For B Sc Physics (Model I)

Time: 3 hours **Maximum Marks: 60**

PART A (Very Short Answer Questions)

*Answer **all** questions. **1** marks each.*

1. Define mass defect.
2. Write a note on HR diagram.
3. Distinguish between leptons and hadrons.
4. Write a short note on nuclear density.
5. What are black holes?
6. State Soddy Fajan's displacement law.
7. Explain thermonuclear reactions.
8. What is a breeder reactor?

(8x1=8)

PART B (Short Answer Questions)

*Answer any **six** questions. Each carries **2** marks.*

9. Give meson theory of nuclear force.
10. Write a note on proton-proton cycle
11. Find the energy release if two H^2 nuclei can fuse together to form $_2He^4$ nucleus. The binding energy per nucleon of H^2 and $_2He^4$ is 1.1MeV and 7MeV respectively.
12. Explain the production of energy in stars by nuclear fusion.
13. Differentiate between half life and mean life.
14. Write a note on primary and secondary cosmic rays.
15. What is carbon dating?
16. Describe the construction and working of an ionisation chamber.
17. Explain electron - positron pair production.
18. Differentiate prompt neutrons and delayed neutrons involved in fission.

(6x2=12)

PART C (Problems/ Derivations/ Short Essays)

*Answer any **four** questions. Each carries **4** marks*

19. Calculate the total binding energy and binding energy per nucleon for $_{26}Fe^{56}$.given mass of neutron = 1.008665 amu and mass of proton = 1.007825 amu.
20. A nuclear reactor is developing energy at a rate of 3000kW. How many atoms of U^{235}undergo fission per second? How many kilograms of U^{235} would be used in 1000hours of operation assuming that on an average energy of 200MeV is released per fission.
21. Bring about the fundamental interactions in nature.
22. The isotope of $_{92}U^{238}$ successively undergoes alpha and beta emission to form $_{82}Fe^{206}$. How many alpha and beta particles are emitted from it?
23. Given that the mass of the sun is 1.98 x 10^{50}Kg and the solar energy is by fusion of 5.64 x10^{11}kg of hydrogen to helium per second. Calculate (i) the energy release in watt and (ii) the time to lapse for the sun to reduce its mass by 1%.
24. Using the baryon number and strangeness number conservation laws, state whether the following reactions are allowed.

$$\pi^- + p \longrightarrow \Lambda^0 + K^0$$

$$\pi^- + p \longrightarrow \Lambda^0 + \pi^0$$

(4x4=16)

PART D (Essays)

*Answer any **two** questions. Each question carries **12** marks*

25. Describe liquid drop model of nucleus. How can the semi-empirical mass formula be derived from it? Mention the uses of this model.
26. Explain the conservation laws and symmetries of elementary particles.
27. Write an essay on nuclear fission giving in detail the mechanism of the process energy release, production of neutrons and chain reaction.
28. Describe the principle and operation of a GM counter as a particle detector.

(2x12=24)

SIXTH SEMESTER B Sc. DEGREE (CBCS) EXAMINATION

PH6CRT12: THERMODYNAMICS AND BASIC STATISTICAL PHYSICS

For B Sc Physics (Model I)

Time: 3 hours **Maximum Marks: 60**

Part A (Very Short Answer Questions)

Answer **all** questions, **1** marks each.

1. State first law of thermodynamics?
2. Distinguish between reversible and irreversible processes.
3. State Carnot's theorem.
4. What is principle of increase of entropy?
5. What is the change in entropy in an adiabatic process?
6. Define Wein's displacememt law.
7. Ten particles are distributed in two equal sized cells. What is the number of possible microstates?
8. What types of particles obey Fermi - Dirac statistics?

(8x1=8)

Part B (Short Answer Questions)

Answer any **six questions,** Each carries **2** marks.

9. Draw the indicator diagram for the Carnot's cycle and mark the different processes in the cycle.
10. Prove that the adiabatic elasticity is γ times the isothermal elasticity.
11. Discuss the third law of thermodynamics.
12. Discuss about the effeciency of a diesel engine.
13. What is the significance of Helmholtz Free Energy?
14. Discuss the variation in the melting point of ice is by the increase of pressure using appropriate theory.
15. What are the peculiar features of black body radiation spectrum?
16. What is a statistical ensemble?
17. Distinguish between macrostate and microstate with a suitable example.

18. How can you differetiate between Quantum and Classical Statistics?

(6x2=12)

Part C (Problems/ Derivations/ Short Essays)

Answer any **four** questions, Each carries **4** marks

19. The efficiency of a Carnot engine can be increased in two ways, by increasing the source temperature or by decreasing the sink temperature. Which one is more effective? Why?
20. One mole of a gas at 90ºC expands isothermally until its volume is thrice the initial volume. Calculate the workdone.
21. Prove that for a reversible adiabatic process
    $\partial T/\partial V = (C_v - C_p)/(\alpha V C_v)$
22. The temperature of 10 kg of water is raised from 0o to 100oC at constant pressure. The heat capacity of water at constant pressure is 4.18 x 103 J/kg K. Calculate increase in entropy of water.
23 Compare the rate at which energy is radiated per unit area of a black body at 300 K and 3000 K. Given $\sigma = 5.669 \times 10^{-8}\ Wm^{-2}K^{-4}$.
24. Three particles are to be distributed in four energy levels. Calculate all possible ways of this distribution when particles are (i) Fermions (ii) Bosons.

(4x4=16)

Part D (Essays)

Answer **any two** questions**,** Each question carries **12** marks

25. Explain in detail the working of an Otto Engine.
26. What are thermodynamic potentials? Derive Maxwell's thermodynamical realtions from these potentials.
27. Discuss the Lee's Disc method for finding the thermal conductivity of a bad conductor.
28. What are fermions? Discuss their statistical distribution.

(2x12=12)

SIXTH SEMESTER B Sc. DEGREE (CBCS) EXAMINATION

PH6CBT01: NANOSCIENCE AND NANOTECHNOLOGY

Choice based course- For B Sc Physics (Model I)

Time: 3 hours **Maximum Marks: 80**

Part A (Very Short Answer Questions)

Answer **all** questions, **1** marks each.

1. What are nanomaterials?
2. What are excitons?
3. Write down the Schrodinger equation for hydrogen atom.
4. What is graphene?
5. Distinguish between nanowires and nanorods?
6. What are buckyballs?
7. What do you mean by magnetoresistance?
8. Write a note on metamaterials?
9. Briefly explain any two applications of nanomaterials in medicine.
10. What are core-shell nanoparticles? **(10 x 1 = 10)**

Part B (Short Answer Questions)

Answer any **eight** questions, Each carries **2** marks.

11. What are quantum dots?
12. Differentiate between nanoscience and nanotechnology.
13. How do electrons moving in one dimension act as a nanowire?
14. Explain quantum leak.
15. Explain the phenomenon of superparamagnetism?
16. With necessary theory explain surface Plasmon resonance in metal nanoparticles?
17. Explain briefly the chemical sensing property of carbon nanotube.
18. Classify the various quantum structures based on their confinement and delocalization direction.
19. What are zeolites?
20. Explain the application of nanomaterials in environment.
21. What is the importance of metamaterials?

22. What do you mean by density of states? Mention some of the properties dependent on density of states? **(8 x 2 = 16)**

Part C (Problems/ Derivations/ Short Essays)

Answer any **six** questions, Each carries **4** marks

23. Give the band structures of metals, semiconductors and insulators.
24. What is porous silicon? Mention some of its properties.
25. Bring out the application of nanomaterials in food and fabric industry.
26. Explain quantum confinement effect in nanomaterials.
27. Write a note on single electron tunnelling.
28. What is nano physical tunnelling effect?
29. Bring out the behaviour of a trapped electron inside an infinite potential well.
30. Write a note on super paramagnetism in nanomaterials.
31. What are the applications of carbon nanotubes?

(6x 4 = 24)

PART D (Essays)

Answer any **two q**uestions. Each question carries **15** marks

32. Discuss the applications of nanomaterials in medicine and energy.
33. (i) What do you mean by quantum size effect?
    (ii) Explain the phenomenon of Surface Plasmon Resonance in metals.
34. Explain the lithographic technique for the synthesis of quantum wire/quantum dots structures.
35. Discuss the various types of carbon nano-tubes. Give their synthesis process and also explain their properties.

(2x15 = 30)

FIRST SEMESTER B Sc. DEGREE (CBCS) EXAMINATION.

PH1CMT01: PROPERTIES OF MATTER, MECHANICS AND WAVES

(Common for B Sc Mathematics & BSc Chemistry)

Time: 3 hours **Maximum Marks: 60**

PART A (Very Short Answer Questions)

Answer** all **questions.** 1 **marks each.

1. Why rails are made in the form of I section?
2. Explain damped oscillations. Write expressions for the same
3. Distinguish between progressive wave and stationary wave.
4. Diamond is said to be hard material. What does it mean in terms of its modulus of elasticity?
5. What is meant by radius of gyration?
6. Why hollow cylinders are preferred in rotating shafts?
7. What is meant by resonance? What is resonant frequency?
8. What are beats?

(8x1=8)

PART B (Short Answer Questions)

*Answer any **six** questions, Each carries **2** marks.*

9. Distinguish between angle of twist and angle of shear. Draw a neat diagram showing the two terms.
10. What are the conditions for an oscillatory motion to be simple harmonic?
11. What do you mean by torsional couple?
12. Define (i) amplitude;(ii) frequency; (iii) time period; and (iv) phase of a body executing SHM.
13. Show that the work done in deforming a body undergoing longitudinal strain is given by ½ (Stress. Strain)
14. State and prove parallel axes theorem.
15. Discuss the terms free oscillation and natural frequency?
16. Obtain the relation between torque and angular momentum.
17. Explain, why a loaded bus is more comfortable than an empty bus?
18. What is Doppler Effect? **(6x2=12)**

PART C (Problems/ Derivations/ Short Essays)

*Answer any **four** questions. Each carries **4** marks*

19. A rubber cord of a catapult has a cross sectional are of 2 mm^2 and an initial length of 0.2 m and is stretched to 0.25 m to fire a small object of mass 15g. If the Young's is $Y = 6 \times 10^8 N/m^2$, what is the initial velocity of the object that is released?
20. A wire of diameter 0.36 mm elongates by 1.2 mm when stretched by a force of 0.32 kg. Wt. It twists through one radian when equal and opposite torques of 1.6×10^{-5} N/m are applied at its ends. Find the Poisson's ratio of the material of the wire.
21. A bicycle wheel has a radius of 30 cm and mass 2 kg and the bicycle is moving at 6 m/s :(a) Calculate the angular velocity of the wheel. (b) Find the angular momentum of the wheel under the assumption that the mass of the wheel is entirely at its edge.
22. The M.I of a cylinder of length Land radius R about its own axis is the same as its M.I about an axis perpendicular to the axis of the cylinder and passing through its centre. Show that L=√3 Rs
23. The velocity of the particle executing SHM is 1 m/s and 0.7 m/s when its distance from its mean position is 30 cm and 60 cm respectively. Find its time period and amplitude.
24. A train standing at the outer signal of a railway station blows a whistle of frequency 400Hz in still air. What is the frequency of the whistle for a platform observer when the train(a)approaches the platform with a speed of 10 ms-1(b) recedes from the platform with a speed of 10 ms^{-1}(c) what is the speed of sound in each case.Take the speed in still air to be 340ms^{-1} **(4 X4 =16)**

PART D (Essays)

*Answer any **two** questions Each question carries **12** marks*

25. Describe torsion pendulum. Explain how it can be used to measure the moment of inertia of an irregular body and torsional rigidity?
26. Obtain the differential equation for a damped harmonic oscillator. Discuss the conditions for it to be over damped, critically damped and under damped.
27. Define moment of inertia. Derive the moment of inertia of a thin uniform rod about an axis perpendicular to its length and passing through : i) its centre of mass, and (ii) one end?

28. What is meant by a plane progressive harmonic wave? Distinguish between transverse and longitudinal wave and obtain an expression for a plane progressive wave in general?

(2x12=24)

SECOND SEMESTER B Sc. DEGREE (CBCS) EXAMINATION.
PH2CMT02: THERMODYNAMICS, FLUID DYNAMICS, ELECTRIC AND MAGNETIC PHENOMENA

(Common for B Sc Mathematics & BSc Chemistry)

Time: 3 hours **Maximum Marks: 60**

PART A (Very Short Answer Questions)

*Answer **all** questions, **1** marks each.*

1. Give the third law of thermodynamics
2. What are lubricants?
3. State the conditions for thermal equilibrium of a system
4. What do you mean by surface tension of a liquid?
5. Explain the significance of permittivity of a medium?
6. What are ferromagnetic domains?
7. Mention the different mechanisms of polarization in a dielectric?
8. State curie law for paramagnetism

(8x1=8)

PART B (Short Answer Questions)

*Answer any **six** questions, Each carries **2** marks.*

9. Differentiate ferromagnetic and ferrimagnetic materials
10. What is dielectric polarization? Explain
11. Distinguish between streamline and turbulent flow?
12. Distinguish between isothermal and adiabatic changes with examples.
13. Explain the range of molecular attraction?
14. State and explain the relation connecting the displacement vector, polarization vector and the electric field in a dielectric.
15. Explain diamagnetism with examples
16. Illustrate adiabatic process.
17. What is the principle involved in the functioning of a refrigerator?

18. What are the factors affecting surface tension?

(6x2=12)

PART C (Problems/ Derivations/ Short Essays)

*Answer any **four** questions. Each carries **4** marks*

19. The capacity of a capacitor with dielectric is 10 μF. Find the ratio of plate area to distance between the plates if the value of the dielectric is 5.
20. The susceptibility of paramagnetic $FeCl_3$ is $3.7x10^{-3}$ at 27°C.What will be the value of its relative permeability at 200°Kand 500°K?
21. Calculate the excess pressure between the inside and outside of a soap bubble of radius 0.5 cm. Surface tension of soap solution=$3.2x\ 10^{-2}$ N/m.
22. Calculate the efficiency of Carnot engine working between ice point and steam point.
23. A capillary tube of slength 0.35 m and radius 0.38x10-3 m is fitted horizontally at the bottom of a constant pressure head arrangement in which water level remaina constant at a height of 0.25 m above the axis of the tube. If 40x10-6cubic metre of water flows out through the capillary in 10 minutes, calculate the viscosity of water.
24. Air at 270 A capillary tube of length 0.35 m and radius 0.38x1K is compressed to half of its original volume adiabatically. Calculate the change in temperature. Given γ=1.4.

(4x4=16)

PART D (Essays)

*Answer any **two** questions. Each question carries **12** marks*

25. Derive the Maxwell's thermodynamic relations. Discuss any two applications.
26. Give an account on ferromagnetism and hysteresis analysis.
27. Define coefficient of viscosity for a liquid. Derive Poiseuille's equation for flow of liquid.
28. What are polar and non-polar molecules? Discuss the effect of electric fields on polar dielectrics. What is meant by polarization of dielectric?

(2x12=24)

THIRD SEMESTER B Sc. DEGREE (CBCS) EXAMINATION.

PH3CMT03: ELEMENTS OF MODERN PHYSICS AND ELECTRONICS

(Common for B Sc Mathematics & BSc Chemistry)

Time: 3 hours **Maximum Marks: 60**

PART A (Very Short Answer Questions)

*Answer **all** questions. **1** marks each.*

1. What is the significance of knee voltage?
2. What are isotopes? Give examples.
3. Explain the term photoelectric work function.
4. What is the function of the moderator?
5. Define Q point. What is its importance?
6. Define mass unit. How it is related to energy in electron volts?
7. What are matter waves?
8. What are logic gates?

(8x1=8)

PART B (Short Answer Questions)

*Answer any **six** questions. Each carries **2** marks.*

9. Obtain an expression for half life of a radioactive material.
10. Distinguish between avalanche breakdown and zener breakdown.
11. What is meant by normalized wave function?
12. What is thermonuclear reaction?
13. State and explain the Uncertainty principle.
14. What is zener diode? How it is operated?
15. Briefly explain angular momentum of the nucleus.
16. What is a depletion layer? How is it formed in a PN junction?
17. State the different properties of Boolean algebra.
18. Briefly explain how energy is liberated during fusion process.

(6x2=12)

PART C (Problems/ Derivations/ Short Essays)

*Answer any **four** questions. Each carries **4** marks*

19. A full wave rectifier using four diodes of constant forward resistance of 1.5 Ω is used to rectify an ac voltage of 12V. If the load resistance is 167Ω, Calculate the maximum and mean load current.
20. The half life of radium is 3.82 days. In what time will the activity decays to 1/16 of its original value.
21. A 6.2 zener is connected to load of 500 Ω with a series resistance of 220 Ω to a source of 12V. Calculate (1) output voltage (2) load current (3) zener current.
22. Convert the decimal number 110 in to (1) octal and (2) hexa decimal systems.
23. An electron has speed 1.05 x 10^4 m/s within an accuracy of 0.01%. Calculate the uncertainty in the position of the electron.
24. Calculate amount of energy in KWh released in the fission of one milligram of U^{235} assuming 200MeV of energy is released per fission. Given Avogadro number = 6.023 x 10^{26} 1 KWh = 3.6 x 10^6 J

(4x4=16)

PART D (Essays)

*Answer any **two questions.** Each question carries **12** marks*

25. What is meant by binding energy of a nucleus? Explain the features of the binding energy curve and explain the stability of the nucleus.
26. With a neat diagram describe the action of a full wave bridge rectifier. Compare its merits over that of a centre tap full wave rectifier.
27. Derive the time independent Schrodinger equation for a free particle.
28. What is half adder? Write its truth table. Design a half adder using minimum number of NAND gates.

(2x12=24)

FOURTH SEMESTER B Sc. DEGREE (CBCS) EXAMINATION.
Complementary course: PH4CMT04: OPTICS AND SUPERCONDUCTIVITY
(Common for B Sc Mathematics & B Sc Chemistry)

Time: 3 hours **Maximum Marks: 60**

PART A (Very Short Answer Questions)

*Answer **all** questions. **1** marks each.*

1. What is meant by population inversion?
2. What are coherent sources?
3. State Malu's law. Explain the symbols.
4. Why Newton's rings are circular?
5. Distinguish between Stoke's and Antistoke's lines?
6. What is Fraunhofer diffraction?
7. Write a brief note on Meissner effect.
8. What is double refraction?

(8x1=8)

PART B (Short Answer Questions)

*Answer any **six** questions. Each carries **2** marks.*

9. Explain the working of half wave plate?
10. Explain the term stimulated emission.
11. Differentiate between interference by division of wave front and by division of amplitude.
12. Discuss Brewster's law.
13. Mention four applications of laser.
14. What is the difference between interference and diffraction?
15. Briefly discuss ac Josephson effect.
16. Why do we use lens to prepare Fraunhofer diffraction?
17. Discuss polarization by selective absorption.
18. Can you get a system of Newton's rings with a bright centre?

(6x2=12)

PART C (Problems/ Derivations/ Short Essays)

*Answer any **four** questions. Each carries **4** marks*

19. A parallel beam of light is normally incident on a plane transmission grating having 480 lines nm^{-1} and a second order spectral line is observed at an angle 30^0. Calculate the wavelength of the line.
20. A ray of light is incident on the surface of a plate of glass of refractive index 1.62 at the polarising angle. Calculate the angle of refraction?
21. Explain population inversion in a 3 level system.
22. A superconductor tin has critical temperature of 3.7 K at zero magnetic field and critical field of 0.036 Tesla at 0 K. Find the critical field at 2 K.
23. Find the minimum thickness of a quarter wave plate of quartz for light of wavelength 5893 A^0 Given $n_0 = 1.544$ and $n_E = 1.553$.
24. In a two slit experiment with monochromatic light, fringes are obtained on a screen placed at some distance from the slits. If screen is moved by 5 cm towards the slits, then change in fringe width is 3×10^{-5} m. If the distance between slits is 1mm. Find the wavelength of the light used.

(4x4=16)

PART D (Essays)

*Answer any **two** questions. Each question carries **12** marks*

25. With necessary theory explain Young's double slit experiment. Mention its significance.
26. Explain circular and elliptical polarization.
27. Explain the construction and working of Ruby laser.
28. Discuss the effect of magnetic field on type I and type II superconductors.

(2x12=24)