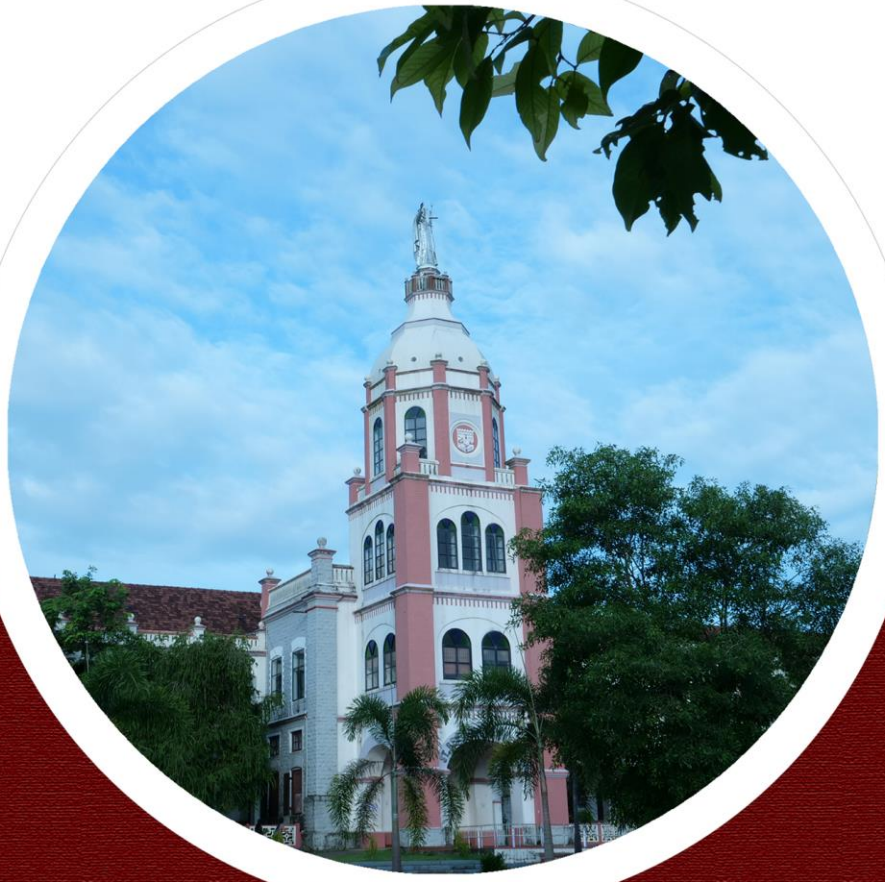
DEPARTMENT OF
PHYSICS



Curriculum and Syllabus for Undergraduate Programmes Under Credit Semester System
(with effect from 2019 admissions)

St Berchmans College
Founded 1922
AUTONOMOUS | College with Potential for Excellence | Reaccredited by NAAC with A Grade
Affiliated to Mahatma Gandhi University, Kottayam, Kerala
Changanassery, Kottayam, Kerala, India-686101

DEPARTMENT OF PHYSICS

Curriculum and Syllabus for Undergraduate Programmes

Under Credit Semester System

(with effect from 2019 admissions)

St Berchmans College
Founded 1922
AUTONOMOUS | College with Potential for Excellence | Reaccredited by NAAC with A Grade
Affiliated to Mahatma Gandhi University, Kottayam, Kerala
Changanassery, Kottayam, Kerala, India-686101

Acknowledgement

The Board of Studies in Physics (PG) acknowledges the contributions from all members in restructuring the curriculum for Under Graduate programme in Physics. The abundant support and recommendations from the sub-groups for designing different courses has shaped this curriculum to this present nature.

We thank all for their benevolent support and cooperation to make this venture a success.

For the Board of Studies in Physics,

Dr Shajo Sebastian

(Chairman)

Preface

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, through this curriculum, 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.

Members of Board of Studies in Physics

Chairman: Dr Shajo Sebastian, Head, Department of Physics

Vice Chancellor's Nominee

1. Dr. Biju P.R. Associate Professor ,School of Pure and Applied Physics, MG University, Kottayam

External Experts

2. Dr. Antony Joseph , Professor , Dept. of Physics , University of Calicut, Malappuram
3. Dr. Charles Jose ,Assistant Professor, Department of Physics, CUSAT, Kochi

Corporate Sector

4. Mr. Cecil Augustine, Associate Vice President –Business Development, Rays Future Energy India Pvt Ltd.

Distinguished Alumni

5. Dr. M T Jose, Scientist 'G', IGCAR ,Kalpakkom, Tamilnadu
6. Mr. Manoj N Senior Sub Divisional Engineer ,BSNL, Thiruvalla

Faculty of the Department

1. Dr. Issac Paul
2. Dr. Siby Kurien
3. Dr. Jacob Mathew M
4. Dr. K E Abraham
5. Dr. Gijo Jose
6. Dr. Sajith Mathews T

Programme Structure

The UG programme in Physics must include

(a) Common Courses, (b) Core courses, (c) Complementary Courses, (d) Open Courses and (e) Project.

The number of Courses for the BSc Physics programme should contain 12 compulsory core courses and 1 elective course from the frontier area of the core courses and a project; 8 complementary courses from the relevant subjects- Mathematics and Chemistry for complementing the core of study. There should be 10 common courses, which includes the first and second language of study.

No course shall carry more than 4 credits. The student shall select any Choice based course offered by the department, depending on the availability of teachers and infrastructure facilities, in the institution. Open course shall be offered in any subject and the student have to opt for courses offered by other departments.

Programme 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 (2^{nd} semester), the students should have attained a common level in basic mechanics, properties of matter, a secure foundation in mathematics and other relevant subjects to complement the core for their future courses and developed their experimental and data analysis skills through a wide range of experiments through practical 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 Thermodynamics, Statistical Mechanics Electricity, Electrodynamics and Electronics. They should have been familiar with additional relevant mathematical techniques and other relevant subjects to complement the core and developed their experimental skills through a series of experiments, which also illustrate major themes of the lecture courses.

By the end of the sixth semester, the students should have covered a range of topics in almost all areas of physics including quantum physics, solid state physics, computational physics, electronics etc. and had experience of independent work such as projects; seminars etc. They should have been developed their understanding of core Physics.

Programme Specific Outcome

- Develop a systemic understanding of core physical concepts, principles and theories along with their applications
- Develop proficiency in the analysis of complex physical problems and the use of mathematical or other appropriate techniques to solve them
- Acquire the skills to take measurements in a physics laboratory and analyse the measurements to draw valid conclusions.
- Acquire the skills to communicate effectively by oral, written, computing and graphical means
- Develop the computational skills for control, data acquisition and data analysis in experimental investigations.
- Develop proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics

REGULATIONS FOR UNDERGRADUATE (UG) PROGRAMMES UNDER CREDIT SEMESTER SYSTEM (SB-CSS-UG) 2019

1. SHORT TITLE

1.1 These Regulations shall be called St. Berchmans College (Autonomous) Regulations (2019) governing undergraduate programmes under Credit Semester System.

1.2 These Regulations shall come into force with effect from the academic year 2019 - 20 onwards.

2. SCOPE

2.1 The regulation provided herein shall apply to all regular undergraduate programmes, BA/BSc/BCom/BCA, conducted by St. Berchmans College (Autonomous) with effect from the academic year 2019 - 20.

3. DEFINITIONS

3.1 'University' means Mahatma Gandhi University, Kottayam, Kerala.

3.2 'College' means St. Berchmans College (Autonomous).

3.3 There shall be an Academic Committee nominated by the Principal to look after the matters relating to the SB-CSS-UG system.

3.4 'Academic Council' means the Committee consisting of members as provided under section 107 of the University Act 2014, Government of Kerala.

3.5 'Parent Department' means the Department, which offers a particular undergraduate programme.

3.6 'Department Council' means the body of all teachers of a Department in the College.

3.7 'Faculty Mentor' is a teacher nominated by a Department Council to coordinate the continuous evaluation and other academic activities of the undergraduate programme undertaken in the Department.

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

3.9 'Duration of Programme' means the period of time required for the conduct of the programme. The duration of an undergraduate programme shall be six (6) semesters.

3.10 'Semester' means a term consisting of a minimum 90 working days, inclusive of tutorials, examination days and other academic activities within a period of six months.

3.11 'Course' means a portion of a subject to be taught and evaluated in a semester.

3.12 'Course Teacher' means the teacher who is taking classes on the course.

3.13 'Core Course' means a course in the subject of specialization within a degree programme. It includes a course on environmental studies and human rights.

3.14 'Complementary Course' means a course, which would enrich the study of core courses.

3.15 'Common Course I' means a course that comes under the category of courses for English.

3.16 'Common Course II' means additional language, which can be opted by a student, from among the languages offered by the College.

3.17 The Common Course I and II is compulsory for all students undergoing undergraduate programmes.

3.18 'Open Course' means a course offered by the departments other than the parent department outside the field specialization of the student, which can be opted by a student.

3.19 'Elective Course' means a course, which can be substituted, by equivalent course from the same subject.

3.20 'Vocational Course' means a course that enables the students to enhance their practical skills and ability to pursue a vocation in their subject of specialization.

3.21 'Audit Course' means a course opted by the students, in addition to the compulsory courses, in order to develop their skills and social responsibility.

3.22 'Extra Credit Course' means a course opted by the students, in addition to the compulsory courses, in order to gain additional credit that would boost the performance level and additional skills.

3.23 Extra credit and audit courses shall be completed by working outside the regular teaching hours.

3.24 There will be two categories of extra credit courses, mandatory and optional. Successful completion of mandatory extra credit courses in the respective semester is necessary for the declaration of the result of the candidate from that semester onwards. If a candidate fails to complete the mandatory course, he/she shall complete the same within the tenure of the programme. The completion of optional courses is not mandatory for a pass in the programme. The details of the extra credit and audited courses are given below:

Semester	Course	Type
I	Course on Basic Life Support System and Disaster Management	Compulsory, audit course, Grades shall be given
I to VI	Value Education	Compulsory, extra credit
	Virtual Lab experiments/MOOC	Optional, extra credit
II & III	Add on Course	Compulsory, extra credit, Grades shall be given
Summer vacation following semester II	50 hours (10 days) Social Awareness Programme	Compulsory, extra credit, Grades shall be given
IV	Internship/Skill Training	Compulsory, audit course, Grades shall be given
V	Finishing School	Compulsory, audit course

3.25 'On the Job Training' means a job training course given to the students to acquaint them with various industrial skills.

3.26 'Project' means a regular project work with stated credits on which the student conducts a project under the supervision of a teacher in the parent department/any appropriate research centre in order to submit a dissertation on the project work as specified.

3.27 'Dissertation' means a minor thesis to be submitted at the end of a research work carried out by each student under the supervision of a teacher in the parent department on a specific area.

3.28 'Plagiarism' is the unreferenced use of other authors' material in dissertations and is a serious academic offence.

3.29 'Seminar' means a lecture expected to train the student in self-study, collection of relevant matter from books and internet resources, editing, document writing, typing and presentation.

3.30 'Improvement Examination' is an examination conducted to improve the performance of a student in the courses of a particular semester as per the exam manual.

3.31 'Supplementary Examination' is an examination conducted for students who fail in the courses of a particular semester as per the exam manual.

3.32 The minimum credits, required for completing an undergraduate programme is one hundred and twenty (120).

3.33 'Credit' (C) of a course is a measure of the weekly unit of work assigned for that course in a semester.

3.34 'Course Credit': One credit of the course is defined as a minimum of one (1) hour lecture/minimum of two (2) hours lab/field work per week for eighteen (18) weeks in a semester. The course will be considered as completed only by conducting the final examination.

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

3.36 'Grade Point' (GP) is the numerical indicator of the percentage of marks awarded to a student in a course.

3.37 'Credit Point' (CP) of a course is the value obtained by multiplying the grade point (GP) by the credit (C) of the course.

3.38 'Semester Grade Point Average' (SGPA) of a semester is calculated by dividing total grade points obtained by the student in a semester by total credits of that semester and shall be rounded off to two decimal places.

3.39 'Cumulative Grade Point Average' (CGPA) is the value obtained by dividing the sum of grade points in all the courses obtained by the student for the entire programme by the total credits of the whole programme and shall be rounded off to two decimal places.

3.40 'Institution Average' is the value obtained by dividing the sum of the marks obtained by all students in a particular course by the number of students in respective course.

3.41 'Weighted Average Score' means the score obtained by dividing sum of the products of marks secured and credit of each course by the total credits of that semester/programme and shall be rounded off to two decimal places.

3.42 'Grace Marks' means marks awarded to course/courses as per the choice of the student, in recognition of meritorious achievements of a student in NCC/NSS/Sports/Arts and cultural activities.

3.43 First, Second, Third, Fourth and Fifth position shall be awarded to students who come in the first five places based on the overall CGPA secured in the programme in the first chance itself.

4. PROGRAMME STRUCTURE

4.1. The programme shall include core courses, vocational courses, complementary courses, common courses, open course and elective courses. There shall be a project/dissertation to be undertaken by all students. The programme will also include assignments, seminars, practical, viva-voce, OJT, field visit, industry visit etc., if they are specified in the curriculum.

4.2. Total credits for a programme is one hundred and twenty (120). The credit distribution for various UG programmes is shown below.

Model I BA/BSc

i.	Programme duration	6 Semesters
ii.	Total credits required for successful completion of the programme	120
iii.	Minimum credits required from Core + Elective + Project + Complementary courses	79
iv.	Minimum credits required from Common courses	38
v.	Minimum credits required from Open course	3
vi.	Minimum attendance required	75%

4.3. **Project/Dissertation**

All students shall do a project/research work in the area of core course in the sixth semester. The project/ research work shall be done individually or as a group of maximum five (5) students. The projects/research work shall be identified during the fourth semester of the programme with the help of the supervising teacher. The report of the project/research work shall be submitted to the department during sixth semester and shall be produced before the examiners appointed by the College. The project report/dissertation shall be subject to internal and external evaluation followed by a viva-voce/defence.

4.4. **Evaluations**

The evaluation of each course shall contain two parts.

i Internal or In-Semester Assessment (ISA)

ii External or End-Semester Assessment (ESA)

Both ISA and ESA shall be carried out using indirect grading. The ISA:ESA ratio shall be 1:4, for courses with or without practical. There shall be a maximum of eighty (80) marks for external evaluation and twenty (20) marks for internal evaluation.

4.5. **In-semester assessment**

The components of the internal or in-semester assessment and their marks are as below.

Common Courses

There are four components for ISA, which include attendance, assignment/seminar/in-semester examinations. All the components of the internal assessment are mandatory.

Component	Marks
Attendance	2
Assignment/Seminar	5
Class test	5
Model examination	8
Total	**20**

Marks for attendance

% of Attendance	Marks
Above 90	2
75 – 90	1

(Decimals shall be rounded off to the next higher whole number)

Courses other than common courses without practical

Component	Marks
Attendance	2
Viva	4
Assignment/Seminar	4
Class test	4
Model examination	6
Total	**20**

Marks for attendance

% of Attendance	Marks
Above 90	2
75 – 90	1

(Decimals shall be rounded off to the next higher whole number)

Courses other than common courses with practical

Component	Marks
Attendance	2
Viva	3
Assignment/Seminar	2
Class test	3
Model examination	5
Total	**15**

Marks for attendance

% of Attendance	Marks
Above 90	2
75 – 90	1

(Decimals shall be rounded off to the next higher whole number)

Internal assessment of practical courses

The internal assessment of practical courses shall be conducted either annually or in each semester. The components for internal assessment are given below.

Internal assessment of practical courses evaluated in each semester

Component	Marks
Attendance	1
Lab Test	2
Record*	2
Total	**5**

*Marks awarded for Record shall be related to number of experiments/practicals recorded.

Marks for attendance

% of Attendance	Marks
Above 75	1

(Decimals shall be rounded off to the next higher whole number)

Internal assessment of practical courses evaluated annually

Component	Marks
Attendance	2
Lab Test	4
Record*	4
Total	**10**

*Marks awarded for Record shall be related to number of experiments/practicals recorded.

Marks for attendance

% of Attendance	Marks
Above 90	2
75 – 90	1

(Decimals shall be rounded off to the next higher whole number)

4.6. **Assignments**

Assignments shall be submitted for every course in the first four semesters. At least one assignment for each course shall be submitted in each semester.

4.7. **Seminar**

A student shall present a seminar in the fifth semester.

4.8. **In-semester examination**

Every student shall undergo at least two in-semester examinations as class test and model examination as internal component for every course.

4.9. To ensure transparency of the evaluation process, the ISA mark awarded to the students in each course in a semester shall be published on the notice board according to the schedule in the academic calendar published by the College. There shall not be any chance for improvement for ISA. The course teacher and the faculty mentor shall maintain the academic record of each student registered for the course which shall be forwarded to the office of the Controller of Examinations through the Head of the Department and a copy shall be kept in the office of the Head of the Department for at least two years for verification.

4.10. A student who has not secured minimum marks in internal examinations can redo the same before the end semester examination of the semester concerned.

4.11. **End-semester assessment**

The end-semester examination in theory and practical courses shall be conducted by the College.

4.12. The end-semester examinations shall be conducted at the end of each semester. There shall be one end-semester examination of three (3) hours duration in each lecture based course.

4.13. The question paper shall be strictly on the basis of model question paper set by Board of Studies.

4.14. A question paper may contain short answer type/annotation, short essay type questions/problems and long essay type questions. Marks for each type of question can vary from programme to programme, but a general pattern may be followed by the Board of Studies.

4.15. End-semester Examination question pattern shall be as given below.

Courses without practical

Section	Total No. of Questions	Questions to be Answered	Marks	Total Marks for the Section
A	12	10	2	20
B	9	6	5	30
C	4	2	15	30
			Maximum	**80**

Courses with practical

Section	Total No. of Questions	Questions to be Answered	Marks	Total Marks for the Section
A	12	10	2	20
B	9	6	4	24
C	4	2	8	16
			Maximum	**60**

4.16. Photocopies of the answer scripts of the external examination shall be made available to the students for scrutiny as per the regulations in the examination manual.

4.17. Practical examination shall be conducted annually or in each semester. The duration and frequency of practical examination shall be decided by the respective Board of Studies.

4.18. Practical examination shall be conducted by one external examiner and one internal examiner.

4.19. The marks for end-semester theory and practical examinations are given below

Course	Marks
Courses without practical	80
Course with practical	60
Practical (assessment in each semester)	20
Practical (odd and even semester combined)	40

4.20. The project report/dissertation shall be subject to internal and external evaluation followed by a viva-voce at the end of the programme. Internal Evaluation is to be done by the supervising teacher and external evaluation by an external evaluation board consisting of an examiner appointed by the Controller of Examinations and the Head of the Department or his nominee. A viva-voce/defence related to the project work shall be conducted by the external evaluation board and students have to attend the viva-voce/defence individually.

Components of Project Evaluation	Marks
Internal Evaluation	20
Dissertation and industry/institution visit report (External)	50
Viva-Voce (External)	30
Total	**100**

4.21. If the student fails in project evaluation, he or she shall submit the project report/dissertation after modifying it on the basis of the recommendations of the examiners.

4.22. For all courses (theory and practical) an indirect grading system based on a seven (7) point scale according to the percentage of marks (ISA + ESA) is used to evaluate the performance of the student in that course. The percentage shall be rounded mathematically to the nearest whole number.

Percentage of Marks	Grade	Performance	Grade Point
95 and above	S	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
45 to below 55	C	Satisfactory	5
35 to below 45	D	Pass	4
Below 35	F	Failure	0

5. CREDIT POINT AND GRADE POINT AVERAGE

5.1. Credit Point

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

CP = C × GP

where C is the credit and GP is the grade point

5.2. Semester Grade Point Average

Semester Grade Point Average (SGPA) is calculated using the formula

SGPA = TCP/TCS

where TCP is the total credit point of all the courses in the semester and TCS is the total credits in the semester

GPA shall be rounded off to two decimal places.

5.3. **Cumulative Grade Point Average**

Cumulative Grade Point Average (CGPA) is calculated using the formula

CGPA = TCP/TC

where TCP is the total credit point of all the courses in the whole programme and TC is the total credit in the whole programme

GPA shall be rounded off to two decimal places.

5.4. **Grade Point Average (GPA)** of different category of courses viz. Common Course I, Common Course II, Complementary Course I, Complementary Course II, Vocational Course, Core Course etc. are calculated using the formula

GPA = TCP/TC

where TCP is the Total Credit Point of a category of course and TC is the total credit of that category of course

Grades for the different courses, semesters, Semester Grade Point Average (SGPA) and grades for overall programme, Cumulative Grade Point Average (CGPA) are given based on the corresponding Grade Point Average (GPA) as shown below:

GPA	Grade	Performance
9.5 and above	S	Outstanding
8.5 to below 9.5	A+	Excellent
7.5 to below 8.5	A	Very Good
6.5 to below 7.5	B+	Good
5.5 to below 6.5	B	Above Average
4.5 to below 5.5	C	Satisfactory
3.5 to below 4.5	D	Pass
Below 3.5	F	Failure

5.5. A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 35% are required for a pass in a course.

5.6. For a pass in a programme, a separate minimum of grade 'D' is required for all the individual courses excluding extra and audited courses.

5.7. 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 the student improves this to D grade or above within the permitted period.

5.8. Candidate who secures D grade and above will be eligible for higher studies.

6. SUPPLEMENTARY/IMPROVEMENT EXAMINATION

6.1 There will be supplementary examinations and chance for improvement. Only one chance will be given for improving the marks of a course.

6.2 There shall not be any improvement examination for practical examinations and examinations of the final year.

7. ATTENDANCE

7.1. The minimum requirement of aggregate attendance during a semester for appearing the end semester examination shall be 75%. Condonation of shortage of attendance to a maximum of ten (10) days in a semester subject to a maximum of two times during the whole period of undergraduate programme may be granted by the College. This condonation shall not be counted for internal assessment.

7.2. Benefit of attendance may be granted to students representing the College, University, State or Nation in Sports, NCC, NSS or Cultural or any other officially sponsored activities such as College union/University union activities etc., on production of participation/attendance certificates, within one week from competent authorities, for the actual number of days participated, subject to a maximum of ten (10) days in a semester, on the specific recommendations of the Faculty Mentor and Head of the Department.

7.3. A student who does not satisfy the requirements of attendance shall not be permitted to appear for the end-semester examinations.

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

8. BOARD OF STUDIES AND COURSES

8.1. The Board of Studies concerned shall design all the courses offered in the UG programme. The Board shall design and introduce new courses, modify or re-design existing courses and replace any existing courses with new/modified courses to facilitate better exposure and training for the students.

8.2. The syllabus of a programme shall contain programme objectives and programme outcome.

8.3. The syllabus of a course shall contain the title of the course, course objectives, course outcome, contact hours, the number of credits, reference materials and model questions.

8.4. Each course shall have an alpha numeric code which includes abbreviation of the course in two letters, the semester number, course code and the serial number of the course.

8.5. Every programme conducted under Credit Semester System shall be monitored by the Academic Council.

9. REGISTRATION

9.1. A student who registers his/her name for the external examination for a semester will be eligible for promotion to the next semester.

9.2. 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.

9.3. A student may be permitted to complete the programme, on valid reasons, within a period of twelve (12) continuous semesters from the date of commencement of the first semester of the programme.

9.4. The minimum strength of students for open courses is 15 and the maximum is 75 per batch.

9.5. Each student shall register for the open courses in the prescribed registration form in consultation with the faculty mentor during fourth semester. Faculty mentor shall permit registration on the basis of the preferences of the student and availability of seats.

10. ADMISSION

10.1. The admission to all UG programmes shall be as per the rules and regulations of the College/University.

10.2. The eligibility criteria for admission shall be as announced by the College/University from time to time.

10.3. Separate rank lists shall be drawn up for seats under reservation quota as per the existing rules.

10.4. There shall be an academic and examination calendar prepared by the College for the conduct of the programmes.

11. MARK CUM GRADE CARD

11.1. The College under its seal shall issue to the students, a Mark cum Grade Card on completion of each semester, which shall contain the following information.

i. Name of the Student
ii. Register Number
iii. Photo of the student
iv. Degree
v. Programme
vi. Semester and Name of the Examination
vii. Month and Year of Examination
viii. Stream
ix. Course Code, Title and Credits of each course opted in the semester
x. Marks for ISA, ESA, Total Marks (ISA + ESA), Maximum Marks, Letter Grade, Grade Point (GP), Credit Point (CP) and Institution Average in each course opted in the semester
xi. Total Credits, Marks Awarded, Credit Point, SGPA and Letter Grade in the semester
xii. Weighted Average Score
xiii. Result
xiv. Credits/Grade of Extra Credit and Audit Courses

11.2. The final Mark cum Grade Card issued at the end of the final semester shall contain the details of all courses taken during the entire programme including those taken over and above the prescribed minimum credits for obtaining the degree. The final Mark Cum Grade Card shall show the CGPA and the overall letter grade of a student for the entire programme.

12. AWARD OF DEGREE

The successful completion of all courses other than extra and audited courses with 'D' grade shall be the minimum requirement for the award of the degree.

13. MONITORING COMMITTEE

There shall be a Monitoring Committee constituted by the Principal to monitor the internal evaluation conducted by the College. The Course Teacher, Faculty Mentor, and the College Coordinator shall keep all the records of the continuous evaluation, for at least a period of two years, for verification.

14. GRIEVANCE REDRESSAL MECHANISM

14.1. In order to address the grievance of students regarding ISA, a two-level Grievance Redressal mechanism is envisaged.

14.2. A student can approach the upper level only if grievance is not addressed at the lower level.

14.3. Department level: The Principal shall form a Grievance Redressal Committee in each Department comprising of course teacher and one senior teacher as members and the Head of the Department as Chairman. The Committee shall address all grievances relating to the internal assessment of the students.

14.4. College level: There shall be a College level Grievance Redressal Committee comprising of Faculty Mentor, two senior teachers and two staff council members (one shall be an elected member) and the Principal as Chairman. The Committee shall address all grievances relating to the internal assessment of the students.

15. TRANSITORY PROVISION

Notwithstanding anything contained in these regulations, the Principal shall, for a period of three years from the date of coming into force of these regulations, have the power to provide by order that these regulations shall be applied to any programme with such modifications as may be necessary.

REGULATIONS FOR ADD ON COURSES FOR UNDERGRADUATE PROGRAMMES

1. DEFINITIONS

1.1 'Add On Course General Coordinator' is a senior teacher nominated by the Principal to coordinate and monitor the Add On courses conducted by various departments.

1.2 'Add On Course Coordinator' is a teacher nominated by a Department Council to coordinate the evaluation and other academic activities of the Add On Course undertaken in the Department.

2. COURSE STRUCTURE

2.1 Add On Course shall be completed outside the regular teaching hours of the undergraduate programmes and shall be completed within the first four semesters of the programme.

2.2 The credit will be awarded only if the student get D grade (35% marks) and above.

2.3 A student can earn any number of extra credits according to his/her choice.

2.4 The minimum credits for an Add On Course shall be two (2).

3. EVALUATIONS

The evaluation of each course shall be done internally and contain two parts.

i. Continuous evaluation
ii. Final evaluation

Both continuous evaluation and final evaluation shall be carried out using indirect grading. The marks for continuous evaluation is twenty (20) and that of final evaluation is eighty (80).

Continuous evaluation

The components of the continuous evaluation and their marks are as below.

For all courses without practical

There are two components for continuous evaluation, which include attendance and assignment. All the components of the continuous evaluation are mandatory.

Components	Marks
Attendance	10
Assignment	10
Total	**20**

Marks for attendance

% of Attendance	Marks
90 and above	10
85 - 89	8
80 – 84	6
76 – 79	4
75	2

(Decimals shall be rounded mathematically to the nearest whole number)

For all courses with practical

The components for continuous evaluation of courses with practical are given below.

Components	Marks
Attendance	10
Lab involvement	10
Total	**20**

Marks for attendance

% of Attendance	Marks
90 and above	10
85 - 89	8
80 – 84	6
76 – 79	4
75	2

(Decimals shall be rounded mathematically to the nearest whole number)

Assignments

At least one assignment shall be submitted for each course.

4. **FINAL EVALUATION**

The final evaluation of theory and practical courses shall be conducted by the College/Department. It can be eighty marks written examination or eighty marks project/practical examination or eighty marks written and project/practical examination combined, as decided by the Board of Studies.

4.1 The question paper shall be strictly on the basis of model question paper set by Board of Studies.

4.2 A question paper may contain objective type, short answer type/annotation, short essay type questions/problems and long essay type questions.

4.3 The duration of written examination shall be decided by the respective Board of Studies and the duration of the practical examination shall be decided by the concerned course coordinator.

4.4 Practical examination shall be conducted by one internal examiner.

4.5 For all courses (theory and practical) an indirect grading system based on a seven (7) point scale according to the percentage of marks (ISA + ESA) is used to evaluate the performance of the student in that course. The percentage shall be rounded mathematically to the nearest whole number.

Percentage of Marks	Grade	Performance
95 and above	S	Outstanding
85 to below 95	A+	Excellent
75 to below 85	A	Very Good
65 to below 75	B+	Good
55 to below 65	B	Above Average
45 to below 55	C	Satisfactory
35 to below 45	D	Pass
Below 35	F	Failure

4.6 A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 35% are required for a pass in a course.

5. **ATTENDANCE**

The minimum requirement of aggregate attendance for appearing the final evaluation shall be 75%.

6. **BOARD OF STUDIES AND COURSES**

6.1 The Board of Studies concerned shall design the Add On Course offered by the department. The Board shall design and introduce new Add On Course, modify or redesign existing Add On

Course and replace any existing Add On course with new/modified Add On course to facilitate better exposure and training for the students.

6.2 The syllabus of an Add On course shall also include the title of the course, contact hours, the number of credits, reference materials and question paper pattern.

6.3 Each course shall have an alpha numeric code which includes programme code, abbreviation of the course in two letters, course code and serial number of the course

6.4 The Add On courses conducted under Credit Semester System shall be monitored by the Academic Council.

6.5 For redressing the complaints in connection with the conduct of Add On course, students shall approach the Grievance Redress Committee functioning in the college.

REGULATIONS FOR CERTIFICATE COURSE IN VALUE EDUCATION FOR UNDERGRADUATE PROGRAMMES

Value Education is a compulsory extra credit course for all the students admitted to the undergraduate programmes.

1. **Duration**

   The duration of the course shall be three academic years (six semesters) spanning 60 hrs. There shall be minimum 20 hours in an academic year.

2. **Evaluation**

   The evaluation of each course shall contain two parts.

   i. Continuous evaluation
   ii. Final evaluation

   There shall be a maximum of forty (40) marks for external assessment and ten (10) marks for internal assessment.

   Continuous Evaluation

   Assignment

   The students are supposed to submit at least one assignment in every year and five (5) marks will be given for a submitted assignment

   Attendance

   The minimum requirement of aggregate attendance during a semester for appearing the end final examination shall be 75%.

   Marks for attendance

   Maximum of five (5) marks will be given for attendance as follows.

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

(Decimals shall be rounded off to the next higher whole number)

   Final evaluation

   The final examination shall be conducted by the course coordinator. The final assessment examination shall be conducted at the end of every year. There shall be an annual written examination of one and a half hours (1½) duration. The question paper shall be strictly on the basis of model question paper set by Expert Committee. A question paper consists of short answer type, short essay type and long essay type questions.

   A separate minimum of 30% marks each for internal and external assessment (continuous and final evaluation) and aggregate minimum of 35% are required for a pass in a course.

3. **Grading**

   The total marks of the course shall be one hundred and fifty (150). The grading of the course is as follows:

Percentage of Marks	Grade	Performance
95 and above	S	Outstanding
85 to below 95	A+	Excellent
75 to below 85	A	Very Good
65 to below 75	B+	Good
55 to below 65	B	Above Average
45 to below 55	C	Satisfactory
35 to below 45	D	Pass
Below 35	F	Failure

4. **Award of certificate**

The course is envisaged with three levels in three academic years. There shall be examination in every year. If a student does not acquire minimum marks he/she can continue with further levels. But he/ she shall be eligible to get certificate only after completing all the levels successfully. The certificate will be issued after completing all the levels with minimum grade D for the pass. On successful completion of the course, grade card shall be issued to the students indicating the grade. The college issues the certificate on value education to all the undergraduate students who successfully complete the course. The course shall be completed during the tenure of the programme.

REGULATIONS FOR COURSE ON BASIC LIFE SUPPORT SYSTEM AND DISASTER MANAGEMENT (BLS & DM)

i. The course on BLS & DM shall be conducted by a nodal centre created in the college.

ii. The nodal centre shall include at least one teacher from each department. A teacher shall be nominated as the Director of BLS & DM.

iii. The team of teachers under BLS & DM shall function as the trainers for BLS & DM.

iv. The team of teachers under BLS & DM shall be given intensive training on Basic Life Support System and Disaster Management and the team shall be equipped with adequate numbers of mannequins and kits for imparting the training to students.

v. Each student shall under go five (5) hours of hands on training in BLS & DM organised by the Centre for BLS & DM.

vi. The training sessions shall be organised on weekends/holidays/vacation during the first semester of the programme.

vii. After the completion of the training, the skills acquired shall be evaluated using an online test and grades shall be awarded.

viii. Nodal centre for BLS & DM shall conduct online test and publish the results.

ix. The grading of the course is as follows:

Percentage of Marks	Grade	Performance
95 and above	S	Outstanding
85 to below 95	A+	Excellent
75 to below 85	A	Very Good
65 to below 75	B+	Good
55 to below 65	B	Above Average
45 to below 55	C	Satisfactory
35 to below 45	D	Pass
Below 35	F	Failure

x. Students who could not complete the requirements of the BLS & DM training shall appear for the same along with the next batch. There shall be two redo opportunity.

xi. For redressing the complaints in connection with the conduct of BLS & DM students shall approach the Grievance Redress Committee functioning in the college.

REGULATIONS FOR SOCIAL AWARENESS PROGRAMME (SAP)

i. Social Awareness Programme shall be conducted by a nodal centre created in the college.

ii. The nodal centre shall include at least one teacher from each department. A teacher shall be nominated as the Director of the SAP.

iii. The centre shall identify the areas where the students can serve the society through the SAP.

iv. During the first semester itself, the centre for SAP shall organise programmes to sensitize the students about the significance and relevance of SAP and publish a list of different areas where they can work as volunteers. Students shall register their preferences (three) with the centre for SAP. The centre shall allot students to various areas based on their preference. For the preparation of the allotment list, the marks obtained in the higher secondary examination shall also be used as a criterion. Centre for SAP shall take the help of the Head of the concerned department and the mentor(s) of the concerned batch at the time of finalization of the allotment list.

v. Students shall carry out the voluntary work allotted to them after the regular class hours/weekends/holidays falling in the second semester or the summer vacation following the second semester.

vi. Evaluation of the SAP activity shall be based on the hours of work put in by a student. A minimum of 50 hours of social work (corresponding to 50 marks) is required for the successful completion of SAP. Every additional work beyond the minimum 50 hours shall fetch five (5) marks per hour. Maximum marks shall be 100. Students who donate blood during the second semester shall be given 10 marks upon the production of the certificate from the medical officer. However, Marks earned through blood donation shall not be counted for a pass in the programme. Mark for blood donation shall be awarded only once during the SAP.

vii. Upon completion of SAP, the marks earned and the grades awarded shall be published by the Director of SAP. The grading is as follows:

Percentage of Marks	Grade	Performance
95 and above	S	Outstanding
85 to below 95	A+	Excellent
75 to below 85	A	Very Good
65 to below 75	B+	Good
55 to below 65	B	Above Average
45 to below 55	C	Satisfactory
35 to below 45	D	Pass
Below 35	F	Failure

viii. Two credits shall be awarded to students who complete the requirements of SAP.

ix. Students who could not complete the requirements of the SAP shall appear for the same with the next batch. There shall be two redo opportunity.

x. For redressing the complaints regarding allotment, harassment at the place of work, and the marks and grades awarded students shall approach the Grievance Redress Committee functioning in the college.

xi. Director of SAP has the right to exclude students who are physically handicapped from SAP.

REGULATIONS FOR INTERNSHIP/SKILL TRAINING PROGRAMME

i. Every UG student shall undergo an internship for a minimum period of five days (25 hours) at a centre identified by the concerned department. In the case of disciplines where internship opportunities are scanty (eg. Mathematics) special skill training programmes with duration of five days (25 hours) shall be organised.

ii. Each department shall identify a teacher in charge for internship/skill training programme.

iii. The department shall select institutions for internship/organising skill training programme.

iv. Internship/skill training programme shall be carried out preferably during the summer vacation following the fourth semester or during the Christmas vacation falling in the fourth semester or holidays falling in the semester.

v. At the end of the stipulated period of internship each student shall produce an internship completion cum attendance certificate and an illustrated report of the training he/she has underwent, duly certified by the tutor and Head of the institution where the internship has been undertaken.

vi. Students undergoing skill training programme shall submit a training completion cum attendance certificate and a report of the training he/she has underwent, duly certified by the trainer, teacher co-ordinator of the programme from the concerned department and the head of the department concerned.

vii. Upon receipt of the internship completion cum attendance certificate and illustrated report of the training or a training completion cum attendance certificate and a report of the training, the teacher in charge of internship/skill training programme shall prepare a list of students who have completed the internship/skill training programme and a list of students who failed to complete the programme. Head of the department shall verify the lists and forward the lists to the Controller of Examinations.

viii. Students who could not complete the requirements of the internship/skill training programme shall appear for the same with the next batch. There shall be only one redo opportunity.

REGULATIONS FOR FINISHING SCHOOL

i. The training to help students develop their soft skills and interview skills, 'The Finishing School', shall be coordinated by a nodal centre.

ii. The nodal centre shall include at least one teacher from each department. A teacher shall be nominated as the Director of the nodal centre.

iii. The training shall impart soft skills comprising of language skills, personal presentation and grooming, resume preparation, group discussion techniques, and interview skills among the undergraduate students.

iv. This course shall be conducted during the fifth semester for all the undergraduate students.

v. There will be a total of 20 contact hours which shall be handled by a team of professional members/faculty. In addition, a one-day outbound training session by a team of professional trainers that touches on the aspects of creativity, problem solving and team building shall also be organized.

vi. The students shall be assessed and grades shall be awarded based on the components as shown below.

Component	Marks
Attendance	5
Class Test	10
Assignments	10
Group discussion	10
Interview	15
Total	**50**

vii. The grading of the course is as follows:

Percentage of Marks	Grade	Performance
95 and above	S	Outstanding
85 to below 95	A+	Excellent
75 to below 85	A	Very Good
65 to below 75	B+	Good
55 to below 65	B	Above Average
45 to below 55	C	Satisfactory
35 to below 45	D	Pass
Below 35	F	Failure

viii. For redressing the complaints in connection with the conduct of finishing school students shall approach the Grievance Redress Committee.

VIRTUAL LAB EXPERIMENTS/MOOC

i. There shall be a Nodal officer and a team of teachers to coordinate the logistics for conducting Virtual Lab experiments and MOOC courses and to authenticate the claims of the students regarding the successful completion of the Virtual Lab experiments and or MOOC courses.

ii. Students who are desirous to do Virtual Lab experiments and or MOOC courses shall register with the Nodal officer at the beginning of the experiment session/MOOC course. Students also shall submit proof of successful completion of the same to the Nodal officer.

iii. Upon receipt of valid proof, the nodal officer shall recommend, to the Controller of Examinations, the award of extra credits. In the case of Virtual Lab experiments, 36 hours of virtual experimentation shall equal one credit and in the case of MOOC courses 18 hours of course work shall equal one credit.

iv. College shall arrange infrastructure for taking up Virtual Lab experiments and/or MOOC courses.

Model Mark cum Grade Card

St Berchmans College
Founded 1922
AUTONOMOUS College with Potential for Excellence | Reaccredited by NAAC with A Grade
Affiliated to Mahatma Gandhi University, Kottayam, Kerala
Changanassery, Kottayam, Kerala, India-686101

MARK CUM GRADE CARD

Date:

Name of the Candidate :

Permanent Register Number (PRN) :

Degree :

Programme :

Stream :

Name of Examination :

Photo

Course Code	Course Title	Credits (C)	Marks						Grade Awarded (G)	Grade Point (GP)	Credit Point (CP)	Institution Average	Result
			ISA		ESA		Total						
			Awarded	Maximum	Awarded	Maximum	Awarded	Maximum					
	Common Course I												
	Common Course II												
	Core Course												
	Complementary Course												
	Complementary Course												
	Total												
	Weighted Average Score												
	Semester Result												
	SGPA												
	End of Statement												

Entered by:

Verified by:

Controller of Examinations **Principal**

St Berchmans College
Founded 1922
AUTONOMOUS College with Potential for Excellence | Reaccredited by NAAC with A Grade
Affiliated to Mahatma Gandhi University, Kottayam, Kerala
Changanassery, Kottayam, Kerala, India - 686101, Tel: 91-481-2420025, 9961231314
E-mail: sbc@sbcollege.org Web: www.sbcollege.ac.in

CONSOLIDATED MARK CUM GRADE CARD

Photo

Name of the Candidate :

Permanent Register Number (PRN) :

Degree :

Programme :

Stream :

Date :

Course Code	Course Title	Credits (C)	Marks						Grade Awarded (G)	Grade Point (GP)	Credit Point (CP)	Institution Average	Result
			ISA		ESA		Total						
			Awarded	Maximum	Awarded	Maximum	Awarded	Maximum					
SEMESTER I													
	Common Course I **Common Course II** **Core Course** **Complementary Course** **Complementary Course**												

SEMESTER II													
	Common Course I **Common Course II** **Core Course** **Complementary Course** **Complementary Course**												
SEMESTER III													
	Common Course I **Common Course II** **Core Course** **Complementary Course** **Complementary Course**												
SEMESTER IV													
	Common Course I **Common Course II** **Core Course** **Complementary Course** **Complementary Course**												
SEMESTER V													
	Core Course **Open Course**												
SEMESTER VI													
	Core Course **Project**												

SEMESTER RESULTS

Semester	Marks Awarded	Maximum Marks	Credits	SGPA	Grade	Month & Year of Passing	Result
I II III IV V VI							

PROGRAMME PART RESULTS

Programme Part	Marks Awarded	Maximum Marks	Credits	CGPA	Grade
Common Course I: Common Course II: Core Course: Complementary Course: Complementary Course: Open Course:					
Total					

FINAL RESULT

CUMULATIVE GRADE POINT AVERAGE (CGPA) =

GRADE =

*** Separate grade card is issued for Audit and Extra Credit courses.**
**** Grace Mark awarded.**

Entered by:

Verified by:

Controller of Examinations **Principal**

Reverse side of the Mark cum Grade Card (COMMON FOR ALL SEMESTERS)

Description of the Evaluation Process

Grade and Grade Point

The evaluation of each course comprises of internal and external components in the ratio 1:4 for all Courses. Grades and Grade Points are given on a seven (7) point scale based on the percentage of Total Marks (ISA + ESA) as given in Table 1. Decimals are corrected to the nearest whole number.

Credit Point and Grade Point Average

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

CP = C × GP

where C is the Credit and GP is the Grade Point

Grade Point Average of a Semester (SGPA) or Cumulative Grade Point Average (CGPA) for a Programme is calculated using the formula

SGPA or CGPA = TCP/TC

where TCP is the Total Credit Point for the semester/programme and TC is the Total Credit for the semester/programme GPA shall be rounded off to two decimal places.

The percentage of marks is calculated using the formula;

$$\% \text{ Marks} = \left(\frac{\text{total marks obtained}}{\text{maximum marks}}\right) \times 100$$

Percentage of Marks	Grade	Performance	Grade Point
95 and above	S	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
45 to below 55	C	Satisfactory	5
35 to below 45	D	Pass	4
Below 35	F	Failure	0

Table 1

Grades for the different Semesters and overall Programme are given based on the corresponding GPA, as shown in Table 2.

GPA	Grade	Performance
9.5 and above	S	Outstanding
8.5 to below 9.5	A+	Excellent
7.5 to below 8.5	A	Very Good
6.5 to below 7.5	B+	Good
5.5 to below 6.5	B	Above Average
4.5 to below 5.5	C	Satisfactory
3.5 to below 4.5	D	Pass
Below 3.5	F	Failure

Table 2

Weighted Average Score (WAS) is the score obtained by dividing sum of the products of marks secured and credit of each course by the total credits of that semester/programme and shall be rounded off to two decimal places.

Note: Course title followed by (P) stands for practical course. A separate minimum of 30% marks each for internal and external assessments (for both theory and practical) and an aggregate minimum of 35% marks is required for a pass in each course. For a pass in a programme, a separate minimum of Grade D for all the individual courses and an overall Grade D or above are mandatory. If a candidate secures Grade F for any one of the courses offered in a Semester/Programme, only Grade F will be awarded for that Semester/Programme until the candidate improves this to Grade D or above within the permitted period.

PROGRAMME STRUCTURE

Semester I

Sl. No.	Course Title	Hours/ Week	Credit	Marks
1	Common Course I	5	4	100
2	Common Course I	4	3	100
3	Common Course II	4	4	100
4	Core Course	2	2	75
5	Core Course Practical	2	Evaluation in Semester II	
6	Complementary Course: Mathematics	4	3	100
7	Complementary Course: Chemistry	2	2	75
8	Complementary Course Practical: Chemistry	2	Evaluation in Semester II	
	Total	**25**	**18**	**550**

Semester II

Sl. No.	Course Title	Hours/ Week	Credit	Marks
1	Common Course I	5	4	100
2	Common Course I	4	3	100
3	Common Course II	4	4	100
4	Core Course	2	2	75
5	Core Course Practical	2	2	50
6	Complementary Course: Mathematics	4	3	100
7	Complementary Course: Chemistry	2	2	75
8	Complementary Course Practical: Chemistry	2	2	50
	Total	**25**	**22**	**650**

Semester III

Sl. No.	Course Title	Hours/ Week	Credit	Marks
1	Common Course I	5	4	100
2	Common Course II	5	4	100
3	Core Course	3	3	75
4	Core Course Practical	2	Evaluation in Semester IV	
5	Complementary Course: Mathematics	5	4	100
6	Complementary Course: Chemistry	3	3	75
7	Complementary Course Practical: Chemistry	2	Evaluation in Semester IV	
	Total	**25**	**18**	**450**

Semester IV

Sl. No.	Course Title	Hours/ Week	Credit	Marks
1	Common Course I	5	4	100
2	Common Course II	5	4	100
3	Core Course	3	3	75
4	Core Course Practical	2	2	50
5	Complementary Course: Mathematics	5	4	100
6	Complementary Course: Chemistry	3	3	75
7	Complementary Course Practical: Chemistry	2	2	50
	Total	**25**	**22**	**550**

Semester V

Sl. No.	Course Title	Hours/ Week	Credit	Marks
1	Core Course	3	3	75
2	Core Course	3	3	75
3	Core Course	4	4	75
4	Core Course	4	3	75
5	Open course	3	3	100
6	Core Course Practical	2	Evaluation in Semester VI	
7	Core Course Practical	2		
	Core Course Practical	2		
	Core Course Practical	2		
	Total	**25**	**16**	**400**

Semester VI

Sl. No.	Course Title	Hours/ Week	Credit	Marks
1	Core Course	4	3	75
2	Core Course	3	3	75
3	Core Course	3	3	75
4	Core Course	4	3	75
5	Elective Course	3	3	100
6	Core Course Practical	2	2	50
7	Core Course Practical	2	2	50
8	Core Course Practical	2	2	50
9	Core Course Practical	2	2	50
10	Project & Industry/Institution Visit	-	1	100
	Total	**25**	**24**	**700**
	Grand Total	**-**	**120**	**3300**

OUTLINE OF THE CORE COURSES

Course Code	Course Title	Hours /Week	Total Hours	Credit	ISA	ESA	Total
Semester I							
BBPH101	Foundation Course in Physics	2	36	2	15	60	75
	Mechanics and Properties of Matter Practical (P)	2	36	Evaluation in Semester II			
Semester II							
BBPH202	Mechanics and Properties of Matter	2	36	2	15	60	75
BBPH2P01	Mechanics and Properties of Matter Practical (P)	2	36	2	10	40	50
Semester III							
BBPH303	Basic Electronics	3	54	3	15	60	75
	Optics and Semiconductor Physics Practical (P)	2	36	Evaluation in Semester IV			
Semester IV							
BBPH404	Electricity, Magnetism and Electrodynamics	3	54	3	15	60	75
BBPH4P02	Optics and Semiconductor Physics Practical (P)	2	36	2	10	40	50
Semester V							
BBPH505	Classical Mechanics and Relativity	3	54	3	15	60	75
BBPH506	Physical Optics and Photonics	3	54	3	15	60	75
BBPH507	Environmental Science and Human Rights	4	72	4	15	60	75
BBPH508	Linear Integrated Circuits, Digital Electronics, C++ Programming and Microprocessors	4	72	3	15	60	75
	Electricity and Magnetism Practical (P)	2	36	Evaluation in Semester VI			
	Digital Electronics Practical (P)	2	36				
	Computational Physics Practical (P)	2	36				
	Microprocessor and Photonics Practical (P)	2	36				
Semester VI							
BBPH609	Thermodynamics, Statistical Physics and Astrophysics	4	72	3	15	60	75
BBPH610	Nuclear and Particle Physics	3	54	3	15	60	75
BBPH611	Condensed Matter Physics	3	54	3	15	60	75
BBPH612	Basic Quantum Mechanics and Spectroscopy	4	72	3	15	60	75
	Elective Course	3	54	3	20	80	100
BBPH6P03	Electricity and Magnetism Practical (P)	2	36	2	10	40	50
BBPH6P04	Digital Electronics Practical	2	36	2	10	40	50
BBPH6P05	Computational Physics Practical (P)	2	36	2	10	40	50
BBPH6P06	Microprocessor and Photonics Practical (P)	2	36	2	10	40	50
BBPH6PJ	Project & Industry/Institution Visit	-	-	1	20	80	100

ELECTIVE COURSES

Course Code	Course Title
BBPH6E01	Nanoscience and Nanotechnology
BBPH6E02	Renewable Energy Technology

OUTLINE OF THE COMPLEMENTARY COURSE FOR UNDERGRADUTE PROGRAMME IN MATHEMATICS

Course Code	Course Title	Hours /Week	Total Hours	Credit	ISA	ESA	Total
Semester I							
BDPM101	Properties of Matter, Mechanics and Fourier Analysis	2	36	2	15	60	75
	Properties of Matter, Mechanics and Magnetic Phenomena (P)	2	36	Evaluation in Semester II			
Semester II							
BDPM202	Electric and Magnetic Phenomena, Thermodynamics and Special Theory of Relativity	2	36	2	15	60	75
BDPM2P01	Properties of Matter, Mechanics and Magnetic Phenomena (P)	2	36	2	10	40	50
Semester III							
BDPM303	Quantum Mechanics, Spectroscopy, Nuclear Physics and Digital Electronics	3	54	3	15	60	75
	Spectroscopy, Nuclear Physics, Basic Electronics and Digital Electronics (P)	2	36	Evaluation in Semester IV			
Semester IV							
BDPM404	Physical Optics, Laser Physics and Astrophysics	3	54	3	15	60	75
BDPM4P02	Spectroscopy, Nuclear Physics, Basic Electronics and Digital Electronics (P)	2	36	2	10	40	50

OUTLINE OF THE COMPLEMENTARY COURSE FOR UNDERGRATUTE PROGRAMME IN CHEMISTRY

Course Code	Course Title	Hours /Week	Total Hours	Credit	ISA	ESA	Total
Semester I							
BDPC101	Properties of Matter, Mechanics and Particle Physics	2	36	2	15	60	75
	Properties of Matter, Mechanics and Magnetic Phenomena (P)	2	36	Evaluation in Semester II			
Semester II							
BDPC202	Electric and Magnetic Phenomena, Thermodynamics, Error Analysis and Experimental Methods	2	36	2	15	60	75
BDPC2P01	Properties of Matter, Mechanics and Magnetic Phenomena (P)	2	36	2	10	40	50
Semester III							
BDPC303	Quantum Mechanics, Spectroscopy, Nuclear Physics and Biological Effects of Radiation and Nuclear Medicine	3	54	3	15	60	75
	Spectroscopy, Nuclear Physics, Basic Electronics (P)	2	36	Evaluation in Semester IV			
Semester IV							
BDPC404	Physical Optics, Laser Physics and Superconductivity	3	54	3	15	60	75
BDPC4P02	Spectroscopy, Nuclear Physics, Basic Electronics (P)	2	36	2	10	40	50

OPEN COURSES

Course Code	Course Title	Hours /Week	Total Hours	Credit	ISA	ESA	Total
BOPH501	Physics in Daily Life	3	54	3	20	80	100
BOPH502	Introduction to Astronomy and Cosmology	3	54	3	20	80	100
BOPH503	Renewable Energy	3	54	3	20	80	100

ADD ON COURSES

Course Code	Course Title	Total Hours	Credit	CE	FE	Total
BPHEX01	Electronic and Electrical Equipment Maintenance	36	2			100
BPHEX02	Introduction to Matlab	36	2			100

SEMESTER I

BBPH101: FOUNDATION COURSE IN PHYSICS

Credit: 2

Total Hours: 36

Course Objectives:

1. Description of development of Physics in the last century.
2. Explanation of wave motion and basic experimental procedures.
3. Brief introduction to mathematical physics

Course Outcome:

1. Learn about early scientific developments
2. Enable to represent oscillating physical systems in a mathematical form
3. Learn basic experimental procedures

Prerequisites: Knowledge of elementary Vector calculus and fundamentals of mechanics and oscillations.

Module I

Development of Physics **(8 hours)**

Development of physics in the last century–origin of new scientific concepts-scientific contributions of Galileo-Newton-Einstein-J J Thomson-Curies-Rayleigh-Max Planck-Heisenberg and Schrodinger (qualitative understanding). Contributions of Indian physicists-C V Raman-H J Babha -J C Bose-S N Bose-M N Saha-S Chandrasekhar-Vikram Sarabhai-ECG Sudarsan.

Text Books:

Vignettes in Physics- G. Venkataraman, University Press

A Century of Physics, Bromley D. Allan, Springer-Verlag New York Inc.

Module II

Oscillations and Waves **(18 hours)**

Systems with one degree of freedom-description of simple harmonic motion (SHM)-equation of motion and solutions. Characteristics of SHM-velocity and acceleration in SHM-energy in SHM. Relation between SHM and uniform circular motion-representation of SHM by complex exponential-examples of SHM- mass-spring system-vertical oscillations- simple pendulum- compound pendulam- torsion pendulum. Natural oscillations-damped Oscillations-forced oscillations-resonance.

Waves in one dimension– transverse vibration of a stretched string- wave equation- sinusoidal waves-linear combination of sinusoidal waves- superposition of waves of same frequency and different frequencies- beats. Standing waves in one-dimension- Normal modes of transverse vibrations– boundary conditions and frequencies. Expression for a plane progressive harmonic wave-energy density-intensity.

Text Books:

Chapter 1, 2, 6: The Physics of Waves and Oscillations- N Bajaj, TMH 1st Edition

Chapter 9: Introduction to Electrodynamics- David J Griffiths, 3rd Edn By PHI

Chapters 8, 9: Mechanics, D. S. Mathur, S. Chand

Berkeley Physics– volume 1– Mechanics- Charles Kittel, McGraw Hill 3rd Edn

Vibration, Waves & Acoustics– D. Chattopadhyay–Books & Allied Pvt Ltd, 1st Edn

Module III

Experimental and Mathematical Foundations (10 hours)

Checking relationships with a graph, random errors –mean and-standard deviation.

Position vector, displacement vector and separation vector- ordinary derivatives- gradient-del operator- divergence and curl with geometrical interpretation. Integral calculus- line integral, surface integral and volume integral. Divergence theorem and Stokes' theorem (no derivation).

Least count of instruments- electrical measurement - working principle of galvanometer, voltmeter, ammeter and digital multimeter.

Text Books:

An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, John R. Taylor, Univ. Science Books

Introduction to Electrodynamics- David J Griffiths, 3rd Edn By PHI

Introduction to Mathematical Physics, Charlie Harper, PHI

The theory of Errors in Physical Measurements- J C Pal, New Central Book Agency

Advanced Course in Practical Physics- Chapter-1- D Chattopadhyay, New Central Book Agency

Practical Physics- G L Squires, Third edn. Cambridge University Press

Instrumentation Devices &Systems- C. S. Rangan, G. R. Sarma, V. S. V. Mani, McGraw-Hill

References

1. Vignettes in Physics- G. Venkataraman, University Press
2. Feynman lectures on Physics- Feynman, Leighton, Sands (Pearson Education)
3. Concepts of Modern Physics- Arthur Beisser (McGraw Hill Education)

4. Modern Physics- Kenneth Krane (Wiley)
5. Modern Physics- R Murugeshan and Kiruthiga Sivaprasath (S. Chand Publishing)
6. https://www.nobelprize.org/nobel_prizes/physics/laureates/
7. The Physics of Waves and Oscillations- N Bajaj, TMH 1st Edition
8. Introduction to Electrodynamics- David J Griffiths, 3rd Edn By PHI
9. Mechanics, D. S. Mathur, S. Chand
10. Berkeley Physics– volume 1– Mechanics- Charles Kittel, McGraw Hill 3rd Edn
11. Vibration, Waves & Acoustics– D. Chattopadhyay–Books & Allied Pvt Ltd, 1st Edn
12. An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, John R. Taylor, Univ. Science Books
13. Introduction to Electrodynamics- David J Griffiths, 3rd Edn By PHI
14. Introduction to Mathematical Physics, Charlie Harper, PHI
15. The theory of Errors in Physical Measurements- J C Pal, New Central Book Agency
16. Advanced Course in Practical Physics- Chapter-1- D Chattopadhyay, New Central Book Agency
17. Practical Physics- G L Squires, Third edn. Cambridge University Press
18. Instrumentation Devices &Systems- C. S. Rangan, G. R. Sarma, V. S. V. Mani, McGraw-Hill

SEMESTER II

BBPH202: MECHANICS AND PROPERTIES OF MATTER

Credit: 2

Total Hours: 36

Course Objectives:

1. How to use differential equations and other advanced mathematics in the solution of the problems in mechanics
2. An introduction about properties of solids, liquids and gases

Course Outcome:

1. Represent motion in different coordinate systems
2. Understand the mathematical formulation describing motion in central force fields and analyze problems in this area.
3. Learn physical principles behind many applications related to rotational motion, elasticity and fluid motion

Prerequisites: Knowledge of elementary rotational motion, vectors in rectangular coordinate system, gravitation and elasticity.

Module I

Motion Under Central Forces **(12 hours)**

Motion in plane polar coordinates-velocity and acceleration in polar coordinates-physics in rotating coordinate system-time derivative of a vector in rotating coordinate system-velocity and acceleration-Centrifugal and Coriolis force- Dynamics of a system of particles-center of mass- center of mass coordinates.

Central forces-central force motion as a one body problem-reduced mass-motion under a central force–case of gravitational force-vibration of a diatomic molecule-equation of the orbit-Kepler's laws.

Text Books:

An introduction to Mechanics- Daniel Kleppner & Robert J. Kolenkow, Chapters 1,9,10; McGraw Hill

Mechanics, D. S. Mathur, S. Chand

Elements of Properties of Matter, D. S. Mathur, S. Chand

Fundamentals of Physics – Halliday, Resnik and Walker (John Wiley & sons)

Berkeley Physics – volume 1 – Mechanics 3rd Edn

Module II

Elasticity **(12 hours)**

Young's modulus-bulk modulus-rigidity modulus-Poisson's ratio. Work done per unit volume. Bending of beams- uniform and non-uniform bending-bending moment-flexural rigidity. Young's modulus–cantilever. Twisting couple-torsional rigidity- determination of rigidity modulus using static and dynamic methods.

Text Books:

Elements of Properties of Matter- D.S.Mathur – S.Chand 3rd Edn

Properties of Matter- Brijlal and N. Subrahmaniam – S. Chand 3rd Edn

Fundamentals of Physics – Halliday, Resnik and Walker – John Wiley & sons

B.Sc. Practical Physics by C. L. Arora

Module III

Rotational Mechanics **(6 hours)**

Angular momentum, Rotational kinetic energy, Moment of Inertia- moment of Inertia of a thin annular rod, thin uniform rod ,ring, thin Circular Disc, Annular disc, solid Sphere, Hollow sphere and solid cylinder. Moment of inertia of Flywheel

Text Books:

Fundamentals of Physics – Halliday, Resnik and Walker (John Wiley & sons) 10th Edn

An introduction to mechanics Daniel Kleppner & Robert J. Kolenkow, McGraw Hill 2nd Edn

Berkeley Physics – volume 1 – Mechanics 3rd Edn

Mechanics – D.S. Mathur – S. Chand 3rd Edn

Fluid Motion **(6 hours)**

Kinematics of fluids in motion- methods of describing fluid motion-types of fluid flow-continuity equation- Euler's Equation of motion- Bernoulli's equation from Euler equation. Surface tension-gravity waves-effect of surface tension-ripples.

Text Books:

A Text Book of Fluid Mechanics and Hydraulic Machines, R. K. Bansal, Lakshmi Publications

Chapter 14: Elements of Properties of Matter, D. S. Mathur, S. Chand

Fluid Dynamics- M. D. Raisinghania, S. Chand

References

1. An introduction to mechanics- Daniel Kleppner & Robert J. Kolenkow, McGraw Hill
2. Mechanics, D. S. Mathur, S. Chand
3. Berkeley Physics – volume 1 – Mechanics 3rd Edn

4. Classical Mechanics – Goldstein, Narosa
5. Classical Mechanics- Walter Greiner, Springer
6. Elements of Properties of Matter- D.S.Mathur – S.Chand 3rd Edn
7. Properties of Matter- Brijlal and N. Subrahmaniam – S. Chand 3rd Edn
8. Fundamentals of Physics – Halliday, Resnik and Walker – John Wiley & sons
9. B.Sc. Practical Physics by C. L. Arora
10. Fundamentals of Physics – Halliday, Resnik and Walker (John Wiley & sons) 10th Edn
11. An introduction to mechanics Daniel Kleppner& Robert J. Kolenkow, McGraw Hill 2nd Edn
12. Berkeley Physics – volume 1 – Mechanics 3rd Edn
13. Mechanics – D.S.Mathur – S.Chand 3rd Edn
14. A Text Book of Fluid Mechanics and Hydraulic Machines, R. K. Bansal, Lakshmi Publications
15. Elements of Properties of Matter, D. S. Mathur, S. Chand
16. Fluid Dynamics- M. D. Raisinghania, S. Chand

SEMESTER III

BBPH303: BASIC ELECTRONICS

Credit: 3

Total Hours: 54

Course Objective:

1. Introduces the operation and applications of diodes and transistors.

Course Outcome:

1. Understand the basic concepts in semiconductor electronics and describe electronic circuits.
2. Understand the operation of diodes and transistors in order to design basic circuits
3. Apply the concepts of basic electronic devices to design small signal amplifier circuits and oscillators for various practical applications
4. Identify and apply appropriate theoretical techniques to solve a range of different problems in semiconductor electronics

Prerequisites: Knowledge of conduction in conductors and semiconductors, Knowledge of basic electrical laws such as Ohm's law, Kirchoff's laws etc. , basic knowledge about the doping and biasing of semiconductors.

Module I

P-N Junction Diodes and Diode Circuits **(18 hours)**

P-N junction diode — barrier formation in a P-N Junction diode — current flow mechanism in forward and reverse biased diodes — *V-I* characteristics — expression for diode current (no derivation) — static and dynamic resistances — Junction capacitance — diode equivalent circuit — ideal diode—avalanche breakdown Special type of diodes: Zener diode — zener breakdown - Zener diode characteristics— equivalent diagram of Zener diode — Tunnel diode - Varactor – PIN diode - Schottky diode – LED - Photo diode. Rectifiers: Half wave, centre tapped full wave and bridge rectifiers — circuit diagram, working, input and output wave forms — expression for I_{dc} and I_{rms} — efficiency of a rectifier — ripple factor of half wave and full wave rectifiers — comparison of rectifier circuits. Filter circuits: Shunt capacitor filter — series inductor filter — LC filter — CLC/ π filter Voltage regulation: Zener diode as voltage regulator - Line regulation and Load regulation Clipping and Clamping circuits: Positive clipper — negative clipper — biased clipper —

combinational clipper — circuit diagrams and working — input and output wave forms — positive clamper and negative clamper — input and output wave forms.

Text Books:

A Text Book of Applied Electronics-R.S.Sedha: S.Chand Co. Chapters- 10-13, 19,20.

Basic Electronics-B.L.Theraja: S.Chand Co., Chapters 12- 19.

Module II

Bipolar Junction Transistors (BJT) (18 hours)

Transistor construction — transistor action — working of NPN and PNP transistors Common base, common emitter and common collector configurations and their characteristics — active, saturation and cut off regions — current gains α , β , γ and their relationships - comparison of CE, CB and CC configurations. Transistor Biasing : Leakage currents — thermal runaway — need for biasing — load line — Q-point — factors affecting stability of Q- point - stability factor – different methods of transistor biasing — fixed bias — fixed bias with emitter resistor — voltage divider bias — Transistor equivalent circuits – dc equivalent circuit – ac equivalent circuit - advantages and disadvantages of different biasing methods. Basic Ideas of FET and MOSFET

Text Books:

A Text Book of Applied Electronics-R.S.Sedha,S.ChandCo. Chapters-14-16

Basic Electronics-B.L.Theraja: S.Chand Co. Chapters 4, 20 , 21 & 26.

Module III

Transistors as Amplifiers and Oscillators (18 hours)

Transistor as an Amplifier — small signal operation of CE amplifier — phase reversal, ac and dc equivalent circuits — derivation of input resistance, output resistance, current gain, voltage-gain,power-gain. Classification of power amplifiers — Class A amplifier — overall efficiency of class A amplifier. Multistage Amplifiers: Gain of a multistage amplifier — decibel gain — power gain — types of coupling — analysis of a two stage RC coupled amplifier — frequency response — expression for overall gain (no derivation) —band width — advantage and disadvantage of RC coupling

Feedback in amplifiers: Positive and negative feedback and its effects on input impedance, output impedance and gain — Different types of feedback (Block diagrams only) — Negative feedback in Transistor amplifiers -- CE amplifier without emitter bypass capacitor -- emitter follower.

Transistor as an Oscillator: Sinusoidal oscillators — principle of oscillators — Barkhausen criterion for self sustained oscillations — Tuned collector oscillator — Hartley and Colpitt's Oscillators – RC Phase shift oscillator –expressions for frequency of oscillations — crystal oscillator.

Text Books

A Text Book of Applied Electronics-R.S. Sedha: S. Chand Co., Chapters-22-31

Basic Electronics-B.L. Theraja: S. Chand Co. Chapters 22, 23, 25 & 28

References

1. Electronic principles, 7th Edition, -Albert Malvino and David J Bates; TMH Edn. Pvt Ltd.
2. Electronic Devices and circuits -Allen Mottershead; PHI
3. Principles of Electronics -V.K. Metha, Rohit Mehta, , 11th ed.; S. Chand and Company Ltd, 2011
4. Electronic Principles-Sahdev, Dhanpat Rai Co.
5. Electronic Devices and Circuit Theory-Robert L Boylestad & Louis Nashelsky; PHI, Pearson
6. Electronic Principles and Applications-Schuler;McGraw Hill
7. Foundations of Electronics-D Chattopadhyay, P.C. Rakshit, B Saha, N.N. Purkait;New age International Publishers
8. Electronic Devices and Circuits-Sajeev Gupta;Dhanpat Rai Publications
9. Basic Electronics and Linear Circuits-N.N. Bhargava, D.C. Kulshreshtha & S.C. Gupta;Tata McGraw Hill
10. Introduction to Semiconductor Devices - Kevin & Brennan; Cambridge Univ. Press
11. The Art of Electronics, Paul Horowitz and Winfield Hill; Cambridge Univ. Press

SEMESTER IV

BBPH404: ELECTRICITY, MAGNETISM AND ELECTRODYNAMICS

Credit: 3

Total Hours: 54

Course Objective:

1. Apprise the concepts of electrodynamics and Maxwell equations

Course Outcome:

1. Describe and understand the basic concepts underpinning electricity, magnetism and electrodynamics.
2. Master the technique of deriving and evaluating formulae for the electromagnetic fields from very general charge and current distributions
3. Able to make a mathematical description of electromagnetic phenomena based on basic physical quantities through the fundamental equations of electromagnetism (Maxwell equations)
4. Identify and apply appropriate theoretical techniques to solve a range of different problems in electromagnetism

Prerequisites: Knowledge of Vector analysis, Vector calculus and fundamentals of electricity and magnetism.

Module I

Varying Currents **(8 hours)**

Growth and decay of current in an inductive circuit-charge and discharge of a capacitor through a resistance - measurement of high resistance by capacitor leak method- DC applied to LCR series circuit (charge case)-discharging of capacitor through LR circuit (discharge case)

Text Book: Electricity and Magnetism- J.H. Fewkes & John Yarwood Chapter 5 (university tutorial press)

Alternating Currents and Circuit Theory **(10 hours)**

RMS and peak values-AC through series LCR (acceptor circuit) and parallel LCR circuit (rejecter circuit)-Q factor-power in AC-power factor-measurement of power in AC circuit-AC watt meter- Distribution of three phase current: star connection – delta connection -Ideal voltage and current sources-Thevenin’s and Norton’s theorems- Maximum power transfer theorem- Superposition Theorem

Text Book: Electricity and Magnetism- J.H. Fewkes & John Yarwood chapter 6 (university tutorial press)

Fundamentals of Magnetism and Electricity D N Vasudeva Chapter 21 and 22.

Module II

Electrostatics **(12 hours)**

Electric field- Coulombs law-Continuous charge distribution-Divergence and curl of electrostatic fields, Gauss' Law-Applications Fields due to: Spherically symmetric charge distribution, Uniformly charged spherical conductor, Line charge, Infinite plane sheet of charge, Electric field at a point between two oppositely charged parallel plates. Electric potential-Poisson's equation and Laplace's equation, The potential of a localized charge distribution, Work and Energy in electrostatics-The work done to move a charge - Energy of a point charge distribution and continuous charge distribution.

Text Book: Introduction to Electrodynamics- David J Griffiths- PHI 3rd ed. Chapter 2

Magnetostatics **(8 hours)**

Magnetic fields - Magnetic forces-Currents-Biot-Savart Law-steady currents-magnetic field of a steady current- Straight line currents of Steady currents – Amperes law: The divergence and curl of B. Comparison of magnetostatics and electrostatics

Text Book: Introduction to Electrodynamics- David J Griffiths- PHI 3rd ed . Chapter 5,7 & 8

Module III

Electrodynamics, Maxwell's Equations and Electromagnetic Waves **(16 hours)**

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

Text Book: Introduction to Electrodynamics- David J Griffiths-3rd ed. PHI Chapter 9

References

1. Fundaments of Magnetism and Electricity D N Vasudeva - S Chand
2. Electricity and Magnetism R Murugeshan. S. Chand & Company Ltd.
3. Electrodynamics made simple Dr E.D Dias, Santhosh P Jose, Clare Publishers.
4. Electricity and Magnetism A S Mahajan and AA Rangwala -TMH 4th Edn.
5. Electromagnetics Matthew N Sadiku- Oxford 4th Edn.
6. Electromagnetics with applications Kraus/Fleish 5th Edn. – TMH
7. Electromagnetics J A Edminister 2nd Edn. - TMH
8. Electromagnetic Fields TVS Arunmurthi – S. Chand

SEMESTER V

BBPH505: CLASSICAL MECHANICS AND RELATIVITY

Credit: 3

Total Hours: 54

Course Objective:

1. To develop familiarity with the physical concepts and mathematical methods of classical mechanics.
2. Introduce the essence of special relativity.

Course Outcome:

1. Describe and understand the basic concepts of Lagrange dynamics and Hamiltonian dynamics
2. Able to make a mathematical description of mechanical systems based on fundamental equations of Mechanics
3. Identify and apply appropriate theoretical techniques to solve a range of different problems in Classical Mechanics and Relativity.

Prerequisites: Knowledge of Vector analysis, Vector calculus and fundamentals of mechanics.

Module I

Lagrange Dynamics **(20 hours)**

Coordinate systems (Cartesian, polar, spherical polar), degrees of freedom, Constraints - Examples of holonomic and non-holonomic constraints. Generalized coordinates – Difficulty introduced by the constaints and their removal – Principle of virtual work – D'Alemberts Principle - Lagrange's equations from D' Alembert's principle. Newton's equations from Lagrange's equation – Applications of Lagrange's equation – one dimensional harmonic oscillator – planetary motion – Compound pendulum, L-C circuit. Hamilton's principle. Superiority of Lagrangian mechanics over Newtonian approach. Generalized momentum and cyclic coordinates.

Module II

Hamiltonian Dynamics **(16 hours)**

Hamiltonian and conservation of energy, physical significance. Hamilton's equations of motion –Hamilton's equation in Cartesian and Polar coordinates. Examples of Hamiltonian dynamics – One and two dimensional harmonic oscillator - Motion of a particle in central force field– planetary motion – Compound pendulum.

Symmetry and conservation laws – Homogeneity of space and conservation of linear momentum-Isotropy of space and conservation of angular momentum- Homogeneity of time and conservation of energy.

Text Books: Classical Mechanics – K. Sankara Rao, Prentice Hall of India.

Classical Mechanics, J C Upadhyaya, Himalaya Publishing House.

Module III

Special Theory of Relativity **(18 hours)**

Inertial and non-inertial frames of reference – Galilean transformation – Significance of Michelson – Morley experiment – postulates of SR- Lorentz transformation – spatial contraction - time dilation –relativity of simultaneity- composition of velocities – Mass of a moving particle – Equivalence of mass and energy, Energy and Momentum. Particles with zero mass. Force in relativistic mechanics. Lorentz transformation for force.

Text Books:

Concepts of modern Physics, Arthur Beiser

Classical Mechanics, J C Upadhyaya, Himalaya Publishing House.

Classical Mechanics – K. Sankara Rao, Prentice Hall of India

References:

1 Classical Mechanics - 3rd Edition: Herbert Goldstein, Charles Poole & John Safk, Pearson Education (Indian Edn.)

2 Mechanics, Hans & Puri, TMH

3 Classical Mechanics – Rana & Joag, TMH

4 Classical Mechanics – Greiner, Springer International Edn.

5 Classical Mechanics- Vimal Kumar Jain Ane Books Pvt. Ltd.

6 Classical Mechanics J C Upadhyaya. Himalaya publishing house.

7 Classical Mechanics – David Morin

8 Lagrangian Dynamics – Schaums Outline Series

BBPH506: PHYSICAL OPTICS AND PHOTONICS

Credit: 3

Total Hours: 54

Course Objective:

1. Working knowledge of optical physics, including diffraction, interference, polarization, laser physics and photonics

Course Outcome:

1. Describe and understand the basic concepts in Physical Optics and photonics.
2. Mastering the day to day phenomenon observed in Physical optics and know the working of allied optical instruments
3. Identify and apply appropriate theoretical techniques to understand the phenomenon of holography and fibre
4. Observe and understand the communication system used

Prerequisites: Knowledge of optical phenomenon seen in nature and basic mathematics

Module I

Interference **(12 hours)**

Introduction - Coherence: spatial coherence and temporal coherence - Analytical treatment of 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 -working and applications.

Text Book: Optics by Subramanyam, Brijlal, MN Avadhanalu, S.Chand Chapter 14 and15

Diffraction **(8 hours)**

Fresnel Diffraction – Huygens- Fresnel theory –zone plate –Difference between zone plate and convex lens. Comparison between interference and diffraction –diffraction pattern due to a straight edge, single silt. Fraunhoffer diffraction at a single slit, double slit, N slits, theory of plane diffraction grating.

Text Book: Optics by Subramanyam, Brijlal, MN Avadhanalu, S.Chand Chapter 17 and 18

Module II

Polarization **(16 hours)**

Concept of polarization – (plane of polarization)-polarization by reflection-Brewster's law-polarization by refraction-pile of plates. Polarization by double refraction-(calcite crystal). Anisotropic crystals –optic axis –Double refraction-Huygens explanation of double refraction. Positive and Negative crystals-Electromagnetic theory of double refraction. Types

of polarized light-Retarders or wave plate- Quarter wave plate –Half wave plate- Production and Detection of elliptically and circularly polarized light- Optical Activity-Fresnels Explanation of Optical Rotation-(Analytical treatment not needed) – Specific Rotation

Text Book: Optics by Subramanayam, Brijlal, MN Avadhanalu, S.Chand. Chapter – 20

Module III

Photonics **(18 hours)**

Radiative transitions and emission linewidths. Radiative decay of excited states, homogeneous and inhomogeneous broadenings. Absorption, spontaneous and stimulated emissions. Einstein's A and B Coefficients. Necessary and sufficient conditions for laser action (population invasion and saturation intensity), rate equations for three and four level systems, pumping mechanisms.

Classification of lasers, Type of pumping, He-Ne laser, Ar ion laser, semiconductor laser, Nd YAG laser, CO_2 Laser. Some applications of lasers.

Optical waveguides, numerical aperture, Modes in planar waveguides, Cylindricalfibres. Step index and graded index fibres, single mode and multimode fibres.

Text Books:

Optical Electronics – Ajoy Ghatak and K Thyagarajan, Cambridge

Lasers-Theory and Applications- Ghatak and Thyagarajan, McMillan (2002)

References

1. Optics 3rd edition- Ajoy Ghatak, TMH
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.
6. Arthur Beiser, Shobhit Mahajan, S Rai Choudhury Concept of Modern Physics (2010), Tata Mc Graw Hill Co Ltd, New Delhi
7. Introduction to optics – Pedrotti & Pedrotti
8. Optics – Eugene Hecht & Ganesan

BBPH507: ENVIRONMENTAL SCIENCE AND HUMAN RIGHTS

Credit: 4

Total Hours: 72

Course Objective:

1. Generate an awareness of the environment as a whole and its related problems.
2. Develop an attitude of concern for the environment.
3. Knowledge of some major aspects of human rights

Course Outcomes:

1. Builds knowledge and skills necessary to address complex environmental issue
2. Understand how decisions and actions affect the environment and builds knowledge and skills necessary to address complex environmental issue
3. Develop the sense of awareness about the environment, its various problems and the inter-relationship between man and environment
4. Strengthens the ability to contribute to the resolution of human rights issues and problems.

Prerequisites: Basic knowledge in Physics, Chemistry, Biology and Social Science

Module I

Environment and Environmental Issues (18 hours)

Meaning and importance of environment; abiotic and biotic components; environment and development - Natural resources – renewable and non-renewable- concept of sustainable development

Pollution: air pollution; water pollution; soil pollution; noise pollution; marine pollution, solid waste management: causes, effects and control measures of urban and industrial waste - biodegradable and non-degradable; 3 R’s in waste management, Role of an individual in prevention of pollution.

Global warming and climate change; ozone depletion; greenhouse effect; acid rain; carbon trading, carbon credit; carbon sequestration; IPCC/UNFCC; nuclear accidents and nuclear holocaust, sand mining; wetland reclamation; landscape changes; deforestation; soil erosion. flood and drought, desertification, overexploitation, threats to fresh water resources of Kerala; tourism and its impact on environment.

Module II

Non-renewable and Renewable Energy Sources (18 hours)

Non-renewable energy sources: -Coal, Oil, Natural gas; Nuclear fission energy; Merits and demerits of non-renewable energy.

Renewable energy sources: Biomass energy- Biogas plant - Fixed dome type and moving dome type; Wind energy; Wave energy; Tidal energy; Hydroelectricity; Geothermal energy conversion; Ocean thermal energy conversion; Fusion energy; Hydrogen energy- Production (electrolysis) and storage; Merits and demerits of each renewable energy sources; Storage of intermittently generated renewable energy (qualitative); Fuel cell.

Module III

Solar Energy **(18 hours)**

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

Module IV

Human Rights **(18 hours)**

National and International Perspectives: Definitions of Human Right, Relevance of Human Rights in India-Social Aspects-Economic Aspects-Political Aspects, Human Rights International Norms, UDHR-Civil and political rights-Economic, social and cultural rights-Rights against torture, Discrimination and forced labour-Rights of the child , Human Rights and duties in India- Preamble to the Indian constitution-Human Rights and Duties in Indian constitution

Deprivation of Human Rights-The core issues: Poverty-Overpopulation-Illiteracy-Unsustainable Development, Disadvantageous Groups (Women, Children, SC/ST, Homeless and slum dwellers, physically and mentally handicapped, refugees and internally displaced persons.

Redressal Mechanisms against Human Rights Violation: Judiciary -Government systems for Redressal - NHRC and other Statutory Commissions-Media advocacy-Creation of Human Rights Literacy and Awareness

References

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net

3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.
4. Clark R.S., Marine Pollution, Clanderson Press Oxford
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press.
8. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay
9. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi
10. Mckinney, M.L. and School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
11. Mhaskar A.K., Matter Hazardous, Techno-Science Publication
12. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co.
13. Rao M N. and Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
14. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
15. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media
16. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication
17. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA
18. Rowan Cruft, S. Matthew Liao and Massimo Renzo, 2015, Philosophical Foundations of Human Rights, , Oxford University Press,
19. Aryeh Neier, 2012, The International Human Rights Movement: A History; Princeton University Press,
20. Carl Wellman, 2011, The Moral Dimensions of Human Rights;, Oxford University Press,
21. Helen M. Stacy, 2009, Human Rights for the 21st Century: Sovereignty, Civil Society, Culture, Stanford University Press,
22. Jean-Marc Coicaud; Michael W. Doyle; Anne-Marie Gardner 2003, The Globalization of Human Rights, United Nations University Press,

23. Andrew Clapham; Human rights a very short introduction, Oxford University Press
24. Raman RP; Human rights concepts and concerns, DC Books, Kottayam.
25. Non-Conventional Energy Resources and Utilisation (Energy Engineering), Er. R K Rajput (S Chand & Co.)
26. Non – Conventional Energy Sources: G D Rai (Khanna Publishers)
27. Renewable energy-Power for a sustainable future, Godfrey Boyle (Oxford university press
28. Renewable Energy Technologies: Solanki C S (Prentice-hall Of India Pvt Ltd)
29. Renewable Energy Sources & Their Environmental Impact : Abbasi (Prentice-hall of India Pvt Ltd)
30. Renewable Energy Sources for Sustainable Development N.S. Rathore N.L. Panwar (New India Publishing Agency)
31. Renewable Energy: Ulrich Laumanns And Dieter Uh Dirk Abmann (James & James Science Publishers)

BBPH508: LINEAR INTEGRATED CIRCUITS, DIGITAL ELECTRONICS, C++ PROGRAMMING AND MICROPROCESSORS

Credit: 3

Total Hours: 72

Course Objective:

1. Exposure to digital ICs and digital circuits
2. Description about op-amp's various configurations and applications
3. Study of basic programming concepts and their application through C++
4. Understanding of Basic operation and application of Microprocessors

Course Outcome:

1. Enables to discuss op-amp's various configurations and applications
2. Understand the basic concepts of digital ICs and digital circuits
3. Design and implement programs using C++
4. Develop an insight to computer hardware and computer applications.

Prerequisites: Basic knowledge of electronics and Mathematics

Module I

Operational Amplifiers **(18 hours)**

Introduction – Op-Amp operational Overview – Op-Amp supply voltages – IC Identification – Packages – Parameters. Op-amp as a Voltage Amplifier- Inverting Amplifier – Non inverting amplifier – Non inverting amplifier as a buffer –Voltage follower – Summer Amplifier – Differential Amplifier- Comparators- Integrator – Differentiator.

Number Systems: Decimal, hexadecimal and Binary conversions, Binary arithmetic addition, 1's and 2's complement subtraction, BCD code, Significance of binary number system in digital electronics, microprocessors and in computers.

Text Book: Applied Electronics- R S Sedha, S Chand, Revised Edition

Digital Fundamentals- Thomas L. Floyd, Pearson, 9th Edition; Chapter 2.

Module II

Digital Electronics **(18 hours)**

The Universal Gates- NAND,NOR Gates, The Exclusive-OR and Exclusive-NOR Gates, Laws of Boolean Algebra, De-Morgan's Theorem, Simplification Using Boolean Algebra, Standard Forms of Boolean Expressions, The Karnaugh Map - two, three and four variables. Combinational Logic Using NAND and NOR Gates, Basic Adders, Parallel Binary Adders, Decoders, Encoders, Code Converters, Multiplexers, Demultiplexers, Parity Generators, Parity Checkers, Latches, Edge-Triggered Flip-Flops (S-R, D, J-K, T, M/S JK)

Text Book: Digital Fundamentals- Thomas L. Floyd, Pearson International Edition, 9th Edition, Chapter 3,4, 5, 6 and 7

Module III

Programming in C++ **(18 hours)**

Introduction- C++ programming basics-data types-Operators (arithmetic, relational, logical and assignment operators)- loops and decisions- basic ideas of structures, arrays, functions, objects and classes.

Text Book: Object oriented programming in Turbo C++- Robert Lafore (Galgotia Pub.) Chapter 1,2,3,4.

Module IV

Microprocessors **(18 hours)**

Introduction to microprocessors- microprocessor operations (with relevance to 8085 microprocessor): 8085 bus organization-address bus- data bus- control bus, internal data operations- 8085 registers- accumulator- flags- program counter- stack pointer, externally initiated operations.

The 8085 microprocessor architecture- pinout and signals- internal architecture of 8085 microprocessor. Machine language- assembly language- high level language. Instruction cycle, machine cycle and T state- instruction format- addressing modes. The 8085 instruction set- simple programmes for data transfer, addition and subtraction. Applications of microprocessors in computers.

Text Book: Microprocessor architecture, programming and applications- Ramesh S. Gaonkar (Penram Int. Pub.) Chapter.1, 2, 3, 5, 6, 7. Fundamentals of Microprocessors and microcomputers- B. Ram (Dhanpat Rai Pub.) Chapter 1.

Reference:

1. OpAmp and Linear Integrated Circuits , Ramakant A Gayakwad, PHI 4th Edn
2. Microelectronic circuits - Theory and applications, Sedra and Smith 6th edition
3. Digital design- M Morris Mano PHI
4. Digital principles and applications 6th Edn. Malvino, Leach and Saha TMH
5. Digital Electronics- William H Gothmann PHI
6. Digital circuits and design- S Salivahanan and S Arivazhakan PHI
7. Digital Electronics- Sedha S Chand
8. Pulse, Digital and switching wave forms –Millam and Taub.
9. Digital computer electronics- Malvino, Brown TMH
10. Digital electronics- Tokheim(TMH)

11. Programming with C++ - John R. Hubbard (Mc Graw Hill Pub.)
12. Numerical method with computer programming in C++ - Ghosh (PHI Pub.)

SEMESTER VI

BBPH609: THERMODYNAMICS, STATISTICAL PHYSICS AND ASTROPHYSICS

Credit: 3

Total Hours: 72

Course Objective:

1. Give a thorough understanding of the theory and methods of statistical physics and thermodynamics.
2. Develop a basic knowledge in astrophysics

Course Outcome:

1. To create awareness about heat, working of heat engines and modes of heat transmission
2. Identify and describe the statistical nature of concepts and laws in thermodynamics
3. Use the statistical physics methods, such as Boltzmann distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in some physical systems.
4. Develop an overall idea about the structure and evolution of the universe

Prerequisites: Basics of calculus and quantum mechanics.

Module I

Thermal Physics **(18 hours)**

Thermodynamic systems-Thermodynamic variables and equation of state- Zeroth law-thermodynamic equilibrium-Internal energy- First law- deduction of Mayors relation from first law-isochoric process-isobaric process-adiabatic process-isothermal process-cyclic process-adiabatic equation of a perfect gas-Indicator diagram- Work done during isothermal and adiabatic process-slopes of isothermals and adiabatics-isothermal elasticity-adiabatic elasticity –Carnot's engine and cycle of operations-work done per cycle and efficiency-theory of refrigerator-coefficient of performance- Second law –Carnots theorem-internal combustion engine - efficiency calculation of petrol (Otto engine)- Diesel engine-efficiency of diesel engine.

Text Book: Thermodynamics and Statistical physics Brij Lal, N.Subrahmanyam and P S Hemne (S. Chand &Co, Multi colour edition 2007) Chapters 4,5

Module II

Thermodynamic Relations and Heat Transmission **(18 hours)**

Entropy, entropy changes in reversible and irreversible processes, Entropy – temperature diagrams and equations. Physical significance of entropy. Thermodynamic potentials:

Enthalpy, Gibbs and Helmholtz functions, Maxwell's relations and applications, Clausius Clapeyron Equation, T.ds equations

Modes of heat transfer, Searle's & Lee's experiment, black body radiation, Stefan Boltzmann Law, Wein's displacement law, Rayleigh -Jean's Law, Planck's law (no derivation).

Text book: Thermodynamics and Statistical physics Brij Lal, N. Subrahmanyam and P S Hemne (S. Chand &Co, Multi colour edition 2007) Chapters 5, 6,8,15

Module III

Statistical Mechanics (18hours)

Micro and Macro states, thermodynamic probability, energy states, energy levels, degenerate energy levels, degenerate gas, phase space, concept of entropy and thermodynamic probability. Ensembles. Classical Statistics: Maxwell-Boltzmann Distribution law, thermodynamics of an ideal monoatomic gas, Classical entropy expression.

Quantum Statistics: Need of quantum statistics- Indistinguishability of particles- Spin and Statistics- Ideas of Bose Einstein distribution law and its application to black body radiation, Fermi Dirac Statistics and its application to electron gas

Text book: Thermodynamics and Statistical physics Brij Lal, N. Subrahmanyam and P S Hemne (S. Chand &Co, Multi colour edition 2007) Chapters 9,10,11,12

Module IV

Astrophysics (18 hours)

Stellar Classification, Saha ionization equation, H-R diagram - Main sequence stars, Gravitational contraction - Virial theorem, hydrostatic equilibrium, Star formation – Jean's criterion

Evolution of stars (qualitative treatment)

Evolution near the main sequence, Pre-main sequence contraction, Post-main sequence evolution, Nucleosynthesis, Supernova remnants, Fate of stars-White dwarf, Neutron stars and Black holes (qualitative treatment only).

Text Books: K D Abhyankar: Astrophysics Stars and Galaxies Chapter 10, V.B Bhatia: Textbook of Astronomy and Astrophysics with Elements of Cosmology, Chapter 1 & 5.

Reference:

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. Thermal and Statistical Physics, R.B. Singh, New Academic Science
6. V.B Bhatia, Textbook of Astronomy and Astrophysics with Elements of Cosmology, Narosa Publishing house, 2001.
7. Baidyanath Basu, An introduction to Astrophysics, Prentice-Hall of India, 2006.
8. The Feynman Lectures on Physics, Richard P. Feynman, Pearson

BBPH610: NUCLEAR AND PARTICLE PHYSICS

Credit: 3

Total Hours: 54

Course Objective:

1. Provide an overview of the fields of nuclear and particle physics.

Course Outcome:

1. Intends to explore the interior of nucleus and interaction between nucleons
2. Explores the frontiers in nuclear energy production
3. Gets acquainted with the particles involved in the quantum mechanical world.

Prerequisites: Basic mathematics and quantum mechanics.

Module I

Nuclear Structure and Reactions (18 hours)

Nuclear composition – Nuclear properties: Nuclear radii – Spin and magnetic moment – Binding energy curve – Explanation of fission and fusion using BE curve - Nuclear size- shape- mass and abundance of nuclides- Stable nuclei - Binding energy, Liquid drop model - Semi empirical binding energy formula - Shell model - Meson theory of nuclear forces – Discovery of pion

Elementary ideas of radio activity - half life period- carbon dating- radioactive disintegration- Alpha decay - Tunnel theory of alpha decay - Derivation for the formula for decay constant - q/m of alpha particel, Range-velocity-energy, Beta decay - Positron emission - Electron capture - Inverse beta decay and the discovery of neutrino - Gamma decay - Fundamental ideas of nuclear isomerism and internal conversion

Module II

Nuclear Transformations (12 hours)

The concept of interaction cross section - Reaction rate - Nuclear reactions - Center of mass frame of reference and Q value of a nuclear reaction - Nuclear fission - Nuclear reactors - Breeder reactors - Nuclear fusion -Nuclear fusion in stars – Proton - Proton Cycle - Carbon Nitrogen Cycle - Formation of heavier elements - Fusion reactors.

Biological Effects of Radiation and Nuclear Medicine (6 hours)

Dose, Dose Rate and dose distribution- Damage to critical tissues - Human exposure to radiation

Nuclear medicine: Projection imaging: X-Radiography and the Gamma Camera- Positron emission tomography - Magnetic resonance imaging - Radiation therapy

Module III

Particle Physics **(18 hours)**

Leptons – Electron and positron-neutrinos and anti-neutrinos-other leptons - Hadrons - Resonance particles - Elementary particle quantum numbers - Baryon number- Lepton number strangeness - Isospin - Electric charge - Hyper charge - Basic ideas on symmetries and conservation laws – Quarks: colour and flavour - Fundamental interactions - Field bosons - Basic ideas of quantum chromo dynamics - Higg's boson.

Reference

1. Concepts of Modern Physics, Arthur Beiser, Shobhit Mahajan and S Rai Choudhury, McGraw-Hill Book Co., Inc., New York
2. Nuclear Physics, Principles and applications-John Lilley, Wiley (2006)
3. Modern Physics – R Murugeshan, Er. Kiruthiga Sivaprasath S. Chand Publishing- 18th Edition
4. Modern Physics- Raymond S. Serway, Clement J Moser, Curt A Moyer- 3rdedition (Cengage Learning)
5. Introduction to modern Physics- H.S Mani & G.K Mehta (Affiliated East-West PVT LTD)
6. Introductory nuclear physics by Kenneth S. Krane. (John Wiley & Sons, 1988).
7. Introduction to the physics of nuclei and particles by R.A. Dunlap. (Singapore: Thomson Asia, 2004)
8. Nuclear Physics – Irving Kaplan, Narosa Publishers (2018)
9. Nuclear Physics D C Tayal, Himalaya publishing House (2011)

BBPH611: CONDENSED MATTER PHYSICS

Credit: 3

Total Hours: 54

Course Objective:

1. Give knowledge and understanding of the properties of condensed materials

Course Outcome:

1. Describe and understand the basic concepts in Condensed matter Physics.
2. Mastering the ideas of the distinct properties of materials in the Solid State.
3. Apply the theory to understand how the properties of Solids vary with particle size, and electronic arrangements.

Prerequisites: Knowledge of the properties of different types of solids.

Module I

Crystal Structure and Bonding (12 hours)

Crystal Structure - Crystalline Matter – 14 Bravais Lattice and 7 Crystal Systems – Elements of symmetry-Nomenclature of crystal directions and planes- 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) – Hydrogen binding.

Free Electron Theory and Band Theory of Solids (15 hours)

Free Electron theory in one dimension- Formation of Energy Bands-Bloch Theorem (Statement) - Kronig Penney Model –Brillouin Zones (qualitative) –Effective Mass-Carriers in Solids- Metals, Insulators and Semiconductors-Band Structure-Intrinsic and Extrinsic Semiconductors- Electric Conductivity-Temperature Dependence- Hall effect.

Text Books:

Elementary Solid State Physics, Ali Omar, (Pearson) Chapter1, 2, 5 & 6

Solid State Physics, P.K. Palanisamy, Scitech publications Chapter 1, 2 & 6

Solid State Physics, R.K Puri & V.K. Babber, S. Chand Chapter 3 & 6.

Module II

Dielectric and Magnetic Properties of Solids (10hours)

Review of basic electrostatic equations - Dielectric Constant - Dipole Moment-Polarizability-Clausius-Mosotti Relation- Ferrroelectricity - Classification of Magnetic Materials-Langevin's theory - Paramagmetism - Curie-Weiss Law- Curie temperature -

Antiferromagnetism and Ferrimagnetism – Magnetisation - Magnetic Domain Structure – Spintronics - Spin Waves (basic idea).

Text Books:

M. Elementary Solid State Physics: Ali Omar (Pearson) Chapter 8& 9

Solid State Physics, P.K. Palanisamy, Scitech publications, Chapter 7&8

Solid State Physics, R.K Puri & V.K. Babber, S. Chand Chapter8

Mircea. S. Rogalski & B. Palmer, Solid State Physics. Chapter 8&9

Module III

Superconductivity (10 hours)

Zero resistance - Superconducting Phenomenon - Critical Temperature - Meissner Effect- Type I& II Superconductors - BCS theory (qualitative) - London Equation -Josephson Effect – SQUID - High Tc superconductors and applications.

Text Books:

Elementary Solid State Physics: Ali Omar (Pearson) Chapter 10

Solid State Physics, P.K. Palanisamy, Scitech publications , Chapter 10

Materials Science and Technology (7hours)

Crystalline materials - Liquid Crystals –amorphous materials - Polymers - Thin films properties and applications

Text Books:

Elementary Solid State Physics: Ali Omar (Pearson) Chapter 12

Thin film fundamentals, A. Goswami. New Age International,2008. Chapter1

Nanostructures and Nanomaterials Synthesis, Properties, And Applications, Guozhong Cao, Imperial College Press, 2004 Chapter 3 and 5.

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.
6. Superconductivity, Superfluids and Condensate James F Annett Oxford

BBPH612: BASIC QUANTUM MECHANICS AND SPECTROSCOPY

Credit: 3

Total Hours: 72

Course Objectives:

1. Provide a rigorous exposition to the principles of Quantum mechanics
2. Describe about different atom models, different atomic systems, different coupling schemes and their interactions with magnetic and electric fields.

Course Outcome:

1. Gets familiarized with the historical development of quantum mechanics and the experiments that motivated it.
2. Understands the central concepts and principles in quantum mechanics and will be able to solve Schrodinger equation for simple systems.
3. Achieve knowledge about the interactions of electromagnetic radiation with matter and their applications in spectroscopy.
4. Learn the basics of atomic and the different molecular spectroscopic methods.

Prerequisite: Completed courses in Classical mechanics, Electromagnetic theory and Calculus.

Module I

Particles and Waves **(18 hours)**

Inadequacies in Classical Physics. Blackbody Radiation: Quantum Theory of Light. Photoelectric Effect. Compton Effect. Wave Nature of Matter-.De-Broglie Hypothesis. Wave-Particle Duality. Davisson-Germer Experiment. Wave Packets. Group and Phase Velocities and Relation between them. Heisenberg's Uncertainty Principle (proof not required): Application of uncertainty principle. Ground state energy of hydrogen atom- non existence of electron in the nucleus. Schrodinger Wave Equation. Properties of wave function. Probability interpretation of wave function. Normalization of Wave Function.

Module II

Quantum Mechanics **(18 hours)**

Postulates of Quantum mechanics, Time independent Schrödinger equation, stationary states. Quantum mechanical operators, Eigen function and eigen values, Hermitian operators, Properties of Hermitian operators, Expectation values, Properties of eigen functions and boundary conditions, Probability Density and Probability current density, Ehrenfest theorem (qualitative).

Applications of Time Independent Schrödinger Wave Equation:

Free Particle, Particle in a one-dimensional box, One dimensional barrier problem, Linear harmonic oscillator

Module III

Molecular Spectroscopy **(18 hours)**

Molecular energy levels. Electronic, rotational and vibrational energies – rotational spectra – explanation in terms of rigid rotator model – vibrational energy levels – explanation in terms of harmonic oscillator.

Electronic energy levels of atoms – Fluorescence and phosphorescence – Raman effect – experimental arrangement and results - classical theory and its failure – quantum theory of Raman effect.

Module IV

Atomic Spectra **(18 hours)**

Emission and absorption spectra, atomic spectra, wave number, Bohr atomic model(Bohr's postulates) , Vector atom model, quantum numbers associated with vector atom model, space quantization, electron spin, coupling of orbital and spin angular momentum, spectroscopic terms and their notation, selection rules. Behaviour of magnetic dipole in external magnetic field; Larmors' precession and theorem. Spin orbit interaction energy of the single valance electron.

Coupling Schemes: LS Coupling Scheme and JJ coupling scheme, Interaction energy in L-S coupling (sp configuration), Lande interval rule, Interaction energy in JJ Coupling (sp configuration), comparison of spectral terms in L-S And J-J coupling. Hyperfine structure of spectral lines and its origin; isotope effect, nuclear spin. Zeeman Effect (normal and Anomalous), Lande g-factor, Paschen-Back effect of a single valence electron system. Stark effect of Hydrogen atom.

Text Book: Rajam J B, Atomic Physics (2009), S Chand & Co, New Delhi

References

1. Modern Physics: G Aruldhas & P Rajagopal, PHI Learning Pvt Ltd
2. Modern Physics: R Murugeshan & K Sivaprasath, S Chand.
3. A. Ghatak & S. Lokanathan, Quantum Mechanics: Theory and Applications, Macmillan
4. Quantum Mechanics G. Aruldhas, Premtice Hall of India.
5. Concepts of Modern Physics - Arthur Beiser, Tata Mc Graw Hill.
6. G. Aruldhas; Molecular structure and Spectroscopy
7. C. Banwell and E. Mccash; Fundamentals of Molecular Spectroscopy.
8. Optics and Atomic Physics D P Khandelwal, Himalaya Pub. House

9. Rajam J B, Atomic Physics (2009), S Chand & Co, New Delhi
10. Fewkes J H and Yarwood J Atomic Physics Vol II (1991) Oxford University Press.

ELECTIVE COURSES

BBPH6E01: NANOSCIENCE AND NANOTECHNOLOGY

Credit: 3

Total Hours: 54

Course Objectives:

1. To give an understanding of how physical and magnetic properties were tailored upon Nano structuring.

Course Outcome:

1. Train the students to the fundamental principle and applications of basic characterisation tools used for nanoscience
2. Provide an understanding towards the world of quantum structures, gas phase clusters and their preparations.
3. Give an exposure to the development of MEMS and its applications

Prerequisites: Basic knowledge of quantum mechanics and thermal physics, good understanding of electricity and magnetism

Module I

Basic Physical Properties of Nanostructures (8 hours)

Structure - Size Dependence of Properties -Crystal Structures -Face- Centered Cubic Nanoparticles -Lattice vibrations - -Energy Bands of conductors, insulators and semiconductors- Reciprocal Lattice-Localised particles- Bandgap energy of semiconductors- Effective mass- Fermi Surface, Mobility-(electron and hole)-excitons.

Methods of Characterization (8 hours)

Atomic Structures - Crystallography- Particle Size determination using X-ray diffraction- basic principle and working of a typical powder XRD, Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM)- basic principles, working and applications.

Nanostructured Ferromagnetism (9 hours)

Basics of Ferromagnetism and superparamagnetism, Dynamics of Nanomagnets -Nanopore Containment of Magnetic Particles –Nanocarbon-Ferromagnets-Ferrofluids -Effect of Bulk Nanostructuring of Magnetic Properties – Magneto resistance fundamental ideas-Giant and Colossal Magnetoresistance and its applications.

Text Book: Introduction to Nanotechnology, Charles P. Poole, Jr. and Frank J. Owens, Wiley, 2003 Chapter 2, 3 and 7

Module II

Gas Phase Clusters **(8 hours)**

Introduction-(atom, molecules, clusters and bulk material)-Cluster formation: Pulser Arc, Laser vaporization, Supersonic Nozzle Source, Smoke source, Detection and analysis:- Wein filter, Quadrupole Mass filter, TOF Mass filter. Metal Nanoclusters -Magic Numbers, Semiconductor clusters, Noble gas clusters, Superfluid Clusters – An idea about theoretical Modeling of Nanoparticles.

Text Books:

Nano the essentials, T. Pradeep, TMH, 2007 Chapter 6

Introduction to Nanotechnology, Charles P. Poole, Jr. and Frank J. Owens, Wiley, 2003 Chapter3

Carbon Nanostructures **(7 hours)**

Carbon Molecules -Nature of the Carbon Bond -allotropes of carbon(graphite, CNT, diamond, graphene) -Carbon Clusters –-Small Carbon Clusters-structure of C60 and its single crystal- Orientantional ordering of C_{60}, other buckyballs, Carbon Nanotubes –Fabrication (chemical vapor deposition, arc melting)-Structure- electrical and mechanical Properties

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

Module III

Quantum Wells, Wires, and Dots **(8 hours)**

Definitions of quantum wells, wires and dots- Preparation of Quantum Nanostructures- Size Effects -Potential Wells- -Conduction electrons and dimensionality –basic idea about Fermi Gas and Density of States(DOS) -properties dependent on DOS-Single-Electron Tunneling - -Infrared Detectors -Quantum dot Lasers-Super conductivity

Nanomachines and Nanodevices **(6 hours)**

Microelectromechanical Systems (MEMSs)-Nanoelectromechanical Systems (NEMSs) -Fabrication Nanodevices and Nanomachines -Molecular Switches-schematic representation, one example each for light controlled and voltage controlled molecular switch.

Text Book: Introduction to Nanotechnology, Charles P. Poole, Jr. and Frank J. Owens, Wiley, 2003 Chapter 9 and 13

References:

1. MEMS/NEMS; micro electro mechanical systems/nano electro mechanical systems Volume 1, Design Methods, Cornelius T. Leondes, Springer, 2006.
2. Nano: the essentials, T. PRADEEP, TMH, 2007.

3. Nanoscale Materials, Luis M. Liz-Marzán and Prashant V. Kamat, Kluwer Academic Publishers, 2003
4. Nanoscience, Nanotechnologies and Nanophysics, C. Dupas, P. Houdy and M. Lahmani, Springer-Verlag, 2007.
5. Nanotechnology 101, John Mongillo, Greenwood Press, 2007.
7. What is What in the Nanoworld, A Handbook on Nanoscience and Nanotechnology, Victor E. Borisenko and Stefano Ossicini, WILEY-VCH Verlag, 2008.
9. Semiconductors for Micro and Nanotechnology - An Introduction for Engineers Jan G. Korvink and Andreas Greiner, WILEY-VCH Verlag, 2002.

BBPH6E02: RENEWABLE ENERGY TECHNOLOGY

Credit: 3

Total Hours: 54

Course Objective:

1. Basic knowledge about current energy scenario.
2. Basic knowledge about conventional and nonconventional energy sources

Course Outcome:

1. List and explain the main sources of energy and their primary applications
2. Describe/illustrate basic electrical concepts and energy system components.
3. Create awareness about challenging energy crisis and alternative energy solutions.
4. Describe the challenges and problems related with the use of various energy sources, with regard to the environment and sustainable development

Prerequisites: Concepts of work- power- energy, heat energy- Modes of energy transfer Heat engines, Concepts of Physical optics, Fundamental of Electricity.

Module I

Introduction to Energy Sources **(6 hours)**

Energy consumption as a measure of Prosperity – World energy futures – Energy sources and their availability – New energy technologies – Renewable energy sources

Text Book: Non-conventional Sources of Energy - G D Rai Chapter 1

Solar Energy **(10 hours)**

Solar radiation geometry – Solar radiation measurements – Principles of the conversion of solar radiation in to heat – Flat plate collectors – Energy balance equation and collector efficiency – Concentrating collector: Focusing type–Solar energy storage systems – Solar pond Principle of operation and extraction of thermal energy – Solar electric power generation: Solar photo-voltaic cells

Text Book: Non-conventional Sources of Energy - G D Rai Chapters 2, 3, 4 & 5

Module II

Wind Energy **(10 hours)**

Basic principles of wind energy conversion – site selection considerations – Classification of wind energy conversion systems – types of wind machines – Schemes for electric generation – Applications of wind energy – Environmental aspects.

Text Book: Non-conventional Sources of Energy - G D Rai Chapter 6

Energy from Biomass **(11 hours)**

Biomass conversion technologies – Biomass as a source of energy – Energy plantation – Methods for obtaining energy from biomass – Biogas generation – Biodegradation – Biogas plants – Biogas from waste – Community biogas plants – Thermal gasification of biomass.

Text Book: Non-conventional Sources of Energy - G D Rai Chapter 7

Module III

Energy from the Oceans **(7 hours)**

Energy from Tides – Basic principle of tidal power – Operation methods of utilization of tidal energy – Single cycle and double cycle systems – Advantages and limitations of tidal power generation - Prospects of tidal energy in India.

Text Book: Non-conventional Sources of Energy - G D Rai Chapter 9

Energy storage **(10 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.

Text Book: Sources of Energy - G D Rai Chapter 10

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 11

References:

1. Non – Conventional Energy Sources: G D Rai (Khanna Publishers)
2. Renewable Energy Technologies: Solanki C S (Prentice-Hall of India Pvt Ltd)
3. Renewable Energy Sources & Their Environmental Impact : Abbasi (Prentice-hall of India Pvt Ltd)
4. Renewable Energy Sources for Sustainable Development N.S. Rathore N.L. Panwar (New India Publishing Agency)
5. Renewable Energy : Ulrich Laumanns And Dieter Uh Dirk Abmann (James & James Science Publishers)
6. Understanding Renewable Energy Systems : Volker Quaschning (James & James Science Publishers)
7. Renewable Energy: Global Perspectives : Azmal Hussain (Icfai University Press)
8. New And Renewable Energy Technologies For Sustainable Development : Naim Hamdia Afgan, Da Graca Carvalho Maria, Maria Da Graca Carvalho (Taylor & Francis Group)

9. Renewable Energy from the Ocean : Avery, William H.; Wu, Chih; Craven, John P. (Oxford University Press)
10. Fundamentals of Renewable Energy Systems : Mukherjee D (New Age International (p) Limited)
11. Renewable Energy Sources & Emerging Tech., Kothari D P (Prentice-hall Of India Pvt Ltd)
12. Energy From Biomass : Willeke Palz, D. Pirrwitz (Springer)
13. Understanding Renewable Energy Systems : Volker Quaschning (James & James Science Publishers)
14. Ocean, Tidal, And Wave Energy: Power From The Sea : Lynn Peppas (Crabtree Publishing Company)
15. Fuel Cells, Geothermal Energy And Tidal Power: Emerging Scenario In Alternate Energy : Sameer A Zodgekar (Icfai University Press)

PRACTICAL

Minimum of experiments to be done in each course is 14.

Minimum number of experiments for appearing practical examination is 8.

SEMESTER I & II

BBPH2P01: MECHANICS AND PROPERTIES OF MATTER PRACTICAL

Credit: 2

Total Hours: 72

1. Vernier Calipers – Volume of a cylinder, sphere and hollow cylinder
2. Screw Guage – Volume of a sphere and glass plate
3. Spherometer – Thickness of a glass plate, radius of curvature of a convex surface and a concave surface.
4. Travelling Microscope – Radius of a capillary tube.
5. Multimeter I – Measurement of resistance, potential difference, current
6. Multimeter II – Checking of capacitor, diode, inductance and transistor
7. Cathode Ray oscilloscope – Calibration and measurement of frequency and amplitude
8. Symmetric Compound Pendulum – Determination of acceleration due to gravity (g), radius of gyration(K) and moment of inertia (I)
9. Measurement of density of a solid – Sensibility method to find mass using beam balance.
10. Cantilever – Scale and Telescope – Determination of Young's modulus
11. Constant pressure head – Determination of viscosity of a liquid
12. Variable pressure head – Determination of viscosity of a liquid
13. Capillary rise method – Determination of surface tension
14. Liquid Lens – Determination of optical constants of a convex lens
15. Spectrometer – Angle of Prism
16. Vertical oscillations of a spring – Determination of Young's Modulus
17. Spectrometer – Refractive index of material of prism
18. Potentiometer – Standardization of the potentiometer wire.
19. Diode Characteristics – Forward and reverse characteristics

20. Half wave rectifier – Study of ripple factor and load regulation with and without filter circuit
21. Realization of logic gates – AND, OR and NOT – Using diodes, transistors etc.

(More experiments of equal standard may be included)

SEMESTER III & IV

BBPH4P02: OPTICS AND SEMICONDUCTOR PHYSICS PRACTICAL

Credit: 2

Total Hours: 72

1. Liquid Lens – Determination of refractive index of a liquid – water and unknown liquid
2. Spectrometer – Hollow Prism – Determination of refractive index of liquid
3. Spectrometer – Dispersive power of a prism
4. Zener characteristics – forward and reverse – Study of dynamic and static properties
5. Transistor characteristics – Common Emitter Configuration
6. Full wave rectifier – (center tap) – Study of ripple factor and load regulation with and without filter circuit
7. Full wave rectifier – (bridge) – Study of ripple factor and load regulation with and without filter circuit
8. Voltage regulator using zener diode – Study of line and load regulations
9. Clampers – positive, negative and biased – Study of output waveforms
10. Non- Uniform bending – Pin and microscope- Determination of Youngs Modulus
11. Static Torsion – Determination of Rigidity modulus
12. Asymmetric Compond pendulum – Determination of acceleration due to gravity , radius of gyration and moment of inertia
13. Field along the axis of a coil – Variation of magnetic field along the axis and Bh – using Deflection Magnetometer
14. Potentiometer – Measurement of resistivity
15. Wave shaping RC circuits – Integrator and differentiator
16. Cantilever – Pin and microscope- Determination of Youngs Modulus
17. Potentiometer – Calibration of ammeter
18. Katers Pendulum – Determination of acceleration due to gravity
19. Clippers – positive, negative and biased – study of output waveforms
20. Realization of logic gates – AND, OR and NOT – Using universal gates
21. Kundt’s tube – Determination of velocity of sound

(More experiments of equal standard may be included)

SEMESTER V & VI

BBPH6P03: ELECTRICITY AND MAGNETISM PRACTICAL

Credit: 2

Total Hours: 72

1. Potentiometer – Calibration of low range voltmeter
2. Carey Foster's Bridge – Measurement of resistivity
3. Carey Foster's Bridge – Temperature Coeffcient
4. LCR series and parallel resonant circuit analysis
5. Verification of Thevenin and Norton theorems
6. Verification of Superposition and Maximum power transfer theorems.
7. e/m – Thomson's apparatus – Bar magnet/magnetic focusing
8. Determination of Dielectric constant of a thin sheet/ a liquid
9. Series RL circuits
10. Kirchoffs Law
11. Andersons Bridge
12. Potentiometer – Calibration of high range voltmeter
13. Tangent galvanometer – Ammeter Calibration
14. Field along the axis of a circular coil – moment of magnet- Null method
15. Field along the axis of a circular coil – Vibration magnetometer
16. Searle's Vibration Magnetometer – Magnetic moment
17. Deflection and vibration magnetometer – m and B_h
18. Moving coil galvanometer – figure of merit
19. Conversion of galvanometer into ammeter
20. Conversion of galvanometer into voltmeter
21. Electrochemical equivalent of Copper
22. To determine e/k using transistor
23. BG – Charge Sensitivity – Standard capacitor method
24. BG – Measurement of capacitance
25. BG – Measurement of High resistance by leakage method
26. Spectrometer – Cauchy's constants
27. Spectrometer – Small angled Prism – Normal Emergence
28. Spectrometer – Resolving power of a prism..
29. Spectrometer – Grating – Wavelengths

30.Spectrometer – Grating – dispersive power

31. Spectrometer – small angled prism- Normal incidence

32. Spectrometer – i_1-i_2 curve

33.Spectrometer – Prism i-d curve

(More experiments of equal standard may be included)

BBPH6P04: DIGITAL ELECTRONICS PRACTICAL

Credit: 2

Total Hours: 72

1. Verification of truth table of NAND, NOR, XOR and XNOR gates
2. Verification of De Morgan's theorems – Using IC 7400
3. BCD to 7 segment decoder
4. Realization of Half adder/ Full adder using gates – Verification of truth table
5. Transistor Characteristics – CB configuration
6. Astable Multivibrator using Transistor
7. Astable Multivibrator using IC 555
8. Monostable Multivibrator using IC 555
9. Monostable Multivibrator using Transistor
10. Amplitude modulation using transistor
11. Pulse Width Modulation using IC 555
12. SR Flip Flops using IC 7400 – Verification of truth table
13. Digital counter using IC 7490 / 7495 / 74194 / 74151 – Verification of truth table
14. Bistable multivibrator using IC 555
15. Multiplexer using gates
16. Demultiplexer using gates
17. Shift register – SISO
18. Shift register – SIPO
19. 4-Bit Binary to Gray conversion
20. 4-Bit Gray to Binary conversion
21. JK Flip Flops using IC 7400 & 7410 – Verification of truth table
22. D/A converter using IC 741 – Using binary weighed resistor / R – 2R ladder type
23. A/D converter using IC 741
24. Realization of XOR and Ex NOR using transistor
25. Phase Shift Oscillator – Using transistors
26. LC Oscillator – Colpits/Hartley – using transistors
27. Sweep wave generator using transistor
28. Melde's string – Determination of frequency of given tuning fork
29. Sonometer – Determination of frequency of ac.
30. Sonometer – Determination of frequency of given tuning fork, unknown mass and verification of laws of strings

31. Newtons rings – Determination of wavelength of sodium light
32. Air wedge – Determination of thickness of thin wire

(More experiments of equal standard may be included)

BBPH6P05: COMPUTATIONAL PHYSICS PRACTICAL

Credit: 2

Total Hours: 72

1. Computer programming in C++ – Resistance colour code to numerical value conversion
2. Computer programming in C++ – For different initial velocity and angle of projection, find out time of flight, horizontal range, Maximum height of a Projectile
3. Computer programming in C++ – sorting the numbers in ascending and descending order
4. Computer programming in C++ – Conversion of temperature scale
5. Computer programming in C++ – Solving a quadratic equation
6. Computer programming in C++ – Generation of Fibonacci series
7. Computer programming in C++ – Conversion of a decimal number into binary number
8. Computer programming in C++ – Simple Pendulum – Calculation of 'g' from experimental data
9. Computer programming in C++ – multiplication of two matrices
10. Computer programming in C++ - Solving a linear equation – bisection method
11. Computer Programming in C++ - Solving the differential equation – RK method II order
12. Computer Programming in C++ - Solving an equation by Newton – Raphson Method
13. Newton's law of cooling – Specific heat capacity of a liquid
14. Thermal conductivity of rubber
15. Thermal conductivity of bad conductor – Lee's disc
16. Study of Seebeck effect / Peltier effect
17. Thermistor – Resistance - Temperature characteristics and temperature co-efficient of resistance
18. Schmitt trigger using IC 741
19. Weinbridge Oscillator using IC 741
20. Regulated power supply using zener diode and IC 741 – Study of line and load regulations
21. Voltage multipliers – doubler & tripler
22. Characteristics of FET
23. Study of UJT Characteristics

24. OPAMP – adder and subtractor

25. OPAMP Characteristics – study of CMRR and open loop gain

26. OPAMP – inverter, non-inverter and buffer – study of gain

(More experiments of equal standard may be included)

BBPH6P06: MICROPROCESSOR AND PHOTONICS PRACTICAL

Credit: 2

Total Hours: 72

1. 8085 Processor – BCD addition and subtraction
2. 8085 Processor – sorting in ascending and descending order
3. 8085 Processor – Multiplication of two eight bit numbers with result 16 bit
4. Laser – Grating – Determination of wavelength
5. Laser – Determination of spot size and divergence
6. Optical fibre – Determination of numerical aperture
7. Single slit diffraction using laser – Determination of slit width
8. Ultrasonic waves – Determination of velocity
9. Torsion pendulum – Determination of Rigidity modulus and moment of inertia
10. Torsion Pendulum (method of equal masses) – Determination of Rigidity Modulus and moment of Inertia
11. Koenigs method – Determination of youngs Modulus
12. Flywheel – Determination of Moment of inertia
13. Non Uniform Bending – Optic lever – Determination of Youngs Modulus
14. Spectrometer – Quartz prism – Refractive indices of quartz for the ordinary and extra –ordinary rays
15. Brewsters Angle determination
16. Uniform Bending – Optic lever – Determination of Youngs Modulus
17. Viscosity – Searle's Rotation Viscometer
18. Characteristics of LED – V- I characteristic for different colors
19. Characteristics of solar cell / photodiode – V- I characteristics
20. Characteristics of Light Depend Resistors
21. Stokes method – determination of viscosity of liquid
22. Uniform Bending – Pin and Microscope – Determination of youngs Modulus
23. Planck's constant using LED's of at least 3 different colours
24. Regulated power supply using IC 78XX/79XX etc – Study of line and load regulations
25. Voltage regulator using zener diode and transistor – Study of line and load regulations
26. RC coupled common emitter amplifier – Study of frequency response and bandwidth

(More experiments of equal standard may be included)

References:

1. Advanced course in Practical Physics by D Chattopadhyay
2. Practical Physics – Joseph Ittiavirah, Premnath and Abraham(2005)
3. Practical Physics, CL Arora, S.Chand
4. Practical Physics, Harnam Singh , S Chand
5. Electronics lab manual Vol 1 & 2, K A Navas.
6. A course of Experiments with He –Ne Laser – R.S Sirohi (2nd Edition) Wiley Eastern Ltd.
7. Electronics lab manual Vol 1 & 2, Kuryachan T D and Shyam Mohan S, Ayodhya pub.

COMPLEMENTARY COURSE FOR UNDERGRADUTE PROGRAMME IN MATHEMATICS

SEMESTER I

BDPM101: PROPERTIES OF MATTER, MECHANICS AND FOURIER ANALYSIS

Credit: 2

Total Hours: 36

Course Objective:

1. Brief introduction to mechanics, material properties and Fourier analysis

Course Outcome:

1. Understand some of the basic concepts in Mechanics, Properties of matter and Elasticity.
2. Study the basic concepts behind angular momentum conservation and moment of inertia.
3. Introduces the Fourier series from a Physicist's point of view.

Prerequisites: Basic knowledge of mechanics, properties of matter and mathematical tools.

Module I

Elasticity (13 hours)

Basic ideas on elasticity – Young's modulus- bulk modulus-rigidity modulus-Poisson's ratio-Work done per unit volume- Bending of beams- uniform and non-uniform bending-bending moment-flexural rigidity-Young's modulus–cantilever method - Twisting couple- torsional rigidity- determination of rigidity modulus using static and dynamic methods.

Text Book: Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)

Module II

Rotational Dynamics of Rigid Bodies (10 hours)

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

Text Book: Mechanics- H.S. Hans and S.P. Puri. (Tata McGraw-Hill)

Module III

Oscillations (7 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.

Text Book: Mechanics- H.S. Hans and S.P. Puri. (Tata McGraw-Hill)

Fourier Analysis **(6 hours)**

Fourier's theorem- evaluation of Fourier coefficients- analysis of square wave, saw tooth wave, triangular wave and full wave rectifier-change of interval.

Text Book: B. Arfken and H.J. Weber (Academic press)

Reference:

1. Mechanics- H.S. Hans and S.P. Puri. (Tata McGraw-Hill)
2. Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)
3. Mechanics- J.C. Upadhyaya (Ram Prasad and sons)
4. Mathematical methods for Physicists – G. B. Arfken and H.J. Weber (Academic press)

SEMESTER II

BDPM202: ELECTRIC AND MAGNETIC PHENOMENA, THERMODYNAMICS AND SPECIAL THEORY OF RELATIVITY

Credit: 2

Total Hours: 36

Course Objective:

1. Give an introduction to Special theory of relativity.
2. Brief description about the basics of thermodynamics
3. Introduce various electric and magnetic phenomena

Course Outcome:

1. Understand the theory behind the origin of magnetism and some important magnetic properties observed in nature.
2. Study the fundamental laws of thermodynamics, its underlying concepts and its consequences.
3. Study special relativity and its consequences.

Prerequisites: Basic knowledge of electricity, magnetism, heat, thermodynamics, and mathematical tools.

Module I

Dielectric and Magnetic Properties of Solids (12Hours)

Review of Basic Equations - Dielectric Constant - Dipole Moment-Polarizability-Clausius-Mosotti Relation- Ferrroelectricity - Classification of Magnetic Materials-Langevin's theory - Paramagmetism - Curie-Weiss Law- Curie temperature - Antiferromagnetism and Ferrimagnetism – Magnetisation - Magnetic Domain Structure – Spintronics - Spin Waves.

Text Book: Elementary Solid-State Physics: Ali Omar (Pearson)

Module II

Thermodynamics (12 hours)

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

Text Book: Heat and Thermodynamics- Brijlal and Subrahmanyam (S. Chand &Co)

Module III

Special Theory of Relativity **(12 hours)**

Introduction- Galilean transformation- Newtonian principle of relativity- special theory- postulates- Lorentz transformation- length contraction- time dilation relativity of simultaneity- addition of velocities- conservation of mass, mass-energy relation.

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

Reference:

1. Introduction to Modern Physics- H.S. Mani and G.K. Mehta
2. Elementary Solid State Physics: Ali Omar (Pearson)
3. Solid State Physics, P.K. Palanisamy, Scitech publications
4. Solid State Physics, R.K Puri & V.K. Babber, S. Chand
5. Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)
6. Modern Physics- R. Murugeshan (S. Chand and Co.)
7. Introduction of Electrodynamics- D.J. Griffiths (PHI Pvt. Ltd)
8. Modern Physics- G. Aruldas and P. Rajagopal (PHI Pub)
9. Thermodynamics- Zemansky and Dittmann (Tata McGraw-Hill)
10. Heat and Thermodynamics- Brijlal and Subrahmanyam (S. Chand &Co)

SEMESTER III

BDPM303: QUANTUM MECHANICS, SPECTROSCOPY, NUCLEAR PHYSICS AND DIGITAL ELECTRONICS

Credit: 3

Total Hours: 54

Course Objective:

1. Brief introduction to spectroscopy, nuclear physics and Digital electronics
2. Description of basic ideas of quantum mechanics

Course Outcome:

1. Study the need for quantum approach and the foundations of quantum theory.
2. Study different models of atom and explain the atomic spectra.
3. Study atomic nucleus, stability of nucleus, decay of nucleus and its applications.

Prerequisites: Basic knowledge of modern physics, atomic nuclei, electronics and mathematical tools.

Module I

Elementary Quantum Theory **(12 hours)**

Introduction- black body radiation and Planck's quantum hypothesis-photoelectric effect-Einstein's explanation- de Broglie hypothesis- matter wave- Davisson-Germer experiment-uncertainty principle (derivation not expected) -wave function- conditions-normalization-Schrodinger equation-stationary states- non-normalizable wave functions- box normalization.

Text Books:

Introduction to Modern Physics- H.S. Mani and G.K. Mehta

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

Modern Physics- R. Murugeshan (S. Chand and Co.)

Quantum Physics- S. Gasiorowicz (John Wiley & Sons)

Spectroscopy **(12 hours)**

Atom models- Thomson's model-Rutherford's nuclear atom model-Bohr atom model-Somerfield's relativistic atom model- vector atom model- Fine structure of Hydrogen atom - Rotational and vibrational spectra of rigid diatomic molecules- Raman effect-quantum theory.

Text Books:

Introduction to Modern Physics- H.S. Mani and G.K. Mehta

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

Modern Physics- R. Murugeshan (S. Chand and Co.)

Quantum Physics- S. Gasiorowicz (John Wiley & Sons)

Module II

Atomic Nucleus and Radioactivity (12 hours)

Nuclear constituents- different nuclear types- properties of nuclei- size- mass charge- density- binding energy- packing fraction -nuclear stability -spin - magnetic dipole moment -electric quadrupole moment -properties of nuclear forces -radioactivity- radiations -law of radioactive decay - half life- mean life-radioactivity units -radioactive series-radioactive dating- carbon dating-artificial radioactivity .

Text Books:

Introduction to Modern Physics- H.S. Mani and G.K. Mehta

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

Modern Physics- R. Murugeshan (S. Chand and Co.)

Quantum Physics- S. Gasiorowicz (John Wiley & Sons)

Module III

Digital Electronics (18 hours)

Different number systems – decimal, binary, octal, hexa decimal number systems- conversion between different number systems- binary mathematics addition and subtraction- basic theorems of Boolean algebra- de Morgan's theorems AND, OR, NOT, NAND, NOR, XOR gates- truth tables- half adder- full adder- Flip-flops-SR- clocked SR- D flipflop –JK – T flip flop – Counters – synchronous and asynchronous counters – mod of counters – design of counters(asynchronous) – mod 8 counter – decade counter – multiplexers – demultiplexers – 4 to 1 and 1 to 4.

Text Books:

Basic electronics- B. L. Theraja (S. Chand and Co.)

Digital principles and applications- A. P. Malvino and P. Leach

Reference:

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. Quantum Physics- S. Gasiorowicz (John Wiley & Sons)
5. Basic electronics- B. L. Theraja (S. Chand and Co.)

6. Elements of electronics- M.K. Bagde, S.P. Sngh and K. Singh (S. Chand and Co.)
7. Modern Physics- G. Aruldas and P. Rajagopal (PHI Pub)
8. Digital principles and applications- A. P. Malvino and P. Leach

SEMESTER IV

BDPM404: PHYSICAL OPTICS, LASER PHYSICS AND ASTROPHYSICS

Credit: 3

Total Hours: 54

Course Objective:

1. Brief introduction to physical optics and laser physics
2. Develop a basic knowledge in Astrophysics

Course Outcome:

1. Study theory of interference, diffraction, polarization and some applications.
2. Understand the idea behind stimulated emission, Lasers, types of Lasers and their applications.
3. Study properties and life cycle of stars qualitatively.

Prerequisites: Basic knowledge of optics and mathematical tools.

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- interference in thin films

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) –resolving power- dispersive power

Text Book: A text book of optics- N. Subrahmanyam, Brijlal and M.N. Avadhanulu

Optics- Satyaprakash (Ratan prakash Mandir)

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 – double refraction- 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 textbook of optics- N. Subrahmanyam, Brijlal and M.N. Avadhanulu

Optics- Satyaprakash (Ratan prakash Mandir)

Module III

Laser Physics **(10 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-Neodymiun YAG laser- He-Ne laser- Properties of laser beams- Application of laser beams

Text Books:

A text book of optics- N. Subrahmanyam, Brijlal and M.N. Avadhanulu

Optics- Satyaprakash (Ratan prakash Mandir)

Optics- A. Ghatak (Tata McGraw-Hill)

Astrophysics **(9 hours)**

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

Text Book: An introduction to Astrophysics- Baidyanath Basu

Reference:

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. A text book of optics- N. Subrahmanyam, Brijlal and M.N. Avadhanulu (S. Chand and Co.)
5. Optics- Satyaprakash (Ratan prakash Mandir)
6. Modern Physics- G. Aruldas and P. Rajagopal (PHI Pub)
7. An introduction to Astrophysics- Baidyanath Basu
8. Optics- A. Ghatak (Tata McGraw-Hill)

PRACTICAL

Minimum of experiments to be done in each course is 14.

Minimum number of experiments for appearing practical examination is 8.

SEMESTER I & II

BDPM2P01: PROPERTIES OF MATTER, MECHANICS AND MAGNETIC PHENOMENA

Credit: 2

Total Hours: 72

1. Vernier Calipers -- Volume of cylinder (solid and hollow), sphere.
2. Screw gauge – Radius of wire, volume of sphere and glass piece
3. Beam balance - Mass of a solid (sensibility method)
4. Spectrometer – Angle of the Prism
5. Hare's Apparatus, U Tube – density of liquids
6. Spectrometer - Refractive Index of material of prism.
7. Diode characteristics- ac and dc resistance
8. Coefficient of viscosity of the liquid – Constant Pressure head method
9. Coefficient of viscosity Variable Pressure head method
10. Surface Tension – Capillary rise method
11. Determination of Young's Modulus- Cantilever (Scale and Telescope)
12. Characteristics of Zener diode
13. Fly wheel – Moment of Inertia
14. Torsion pendulum -Rigidity modulus
15. Determination of moment of inertia of rotationally symmetric body (solid sphere **OR** cylinder **OR** disc) from their period of oscillation on a torsion axle
16. Spring constant - Hooke's law - oscillation
17. Resistivity of the material of the wire- Ohm's law and verification by multimeter
18. Construction of half wave rectifier with and without filter – Ripple factor
19. Laser- Transmission **OR** Reflection Grating- Determination of wavelength
20. Liquid lens – optical constants of a lens
21. Poisson's ratio of rubber
22. Symmetric Compound pendulum – Acceleration due to gravity

23. Temperature dependence of capacitance- polymer and ceramic capacitors.

24. Potentiometer – standardization

25. Gates – AND, OR, NOT- verification of truth tables

SEMESTER III & IV

BDPM4P02: SPECTROSCOPY, NUCLEAR PHYSICS, BASIC ELECTRONICS AND DIGITAL ELECTRONICS

Credit: 2

Total Hours: 72

1. Determination of Young's Modulus- Cantilever (Pin & Microscope)
2. Determination of Young's Modulus – Non Uniform bending (Scale & Telescope)
3. Asymmetric Compound Pendulum- Determination of moment of inertia and Acceleration due to gravity (g)
4. Symmetric Compound Pendulum - Determination of Radius of gyration and moment of inertia
5. Torsion pendulum (Equal mass method) - Rigidity modulus and Moment of Inertia
6. Spectrometer – Dispersive power of prism
7. Spectrometer – Grating - wavelengths
8. Newton's rings -Wave length
9. Conversion of Galvanometer into voltmeter
10. Carey Foster's Bridge -Measurement of resistivity
11. Tangent Galvanometer – Ammeter calibration
12. Potentiometer-Calibration of low range ammeter
13. Potentiometer – Resistance of a wire
14. Construction of full wave rectifier (center-tap) with and without filter – Ripple factor
15. Construction of regulated power supply using Zener diode- line and load regulation
16. Laser diffraction- width of single slit **OR** thickness of wire
17. Refractive index of liquid- Liquid Lens
18. Air wedge-thickness of wire
19. Static Torsion - Rigidity modulus
20. Deflection and Vibration Magnetometer-m & Bh
21. Field along the axis of circular coil- determination of Bh
22. Searle's Vibration Magnetometer - magnetic moment
23. Resistance of a galvanometer and its figure of merit

References

1. Practical Physics – C L Arora- S Chand

2. Properties of Matter -D.S. Mathur
3. Optics –Subrahmanyam & Brijlal
4. Electricity &Magnetism -Sreevastava
5. Electronics Lab Manual (Vol.1) -K. A. Navas
6. Laboratory manual for electronic devices and circuits-David A Bell
7. Practical Physics- Joseph Ittiavirah, Premnath and Abraham

COMPLEMENTARY COURSE FOR UNDERGRADUTE PROGRAMME IN CHEMISTRY

SEMESTER I

BDPC101: PROPERTIES OF MATTER, MECHANICS AND PARTICLE PHYSICS

Credit: 2

Total Hours: 36

Course Objective:

1. Brief introduction to mechanics, material properties and Fourier analysis

Course Outcome:

1. Understand some of the basic concepts in Mechanics, Properties of matter and Elasticity.
2. Study the basic concepts behind angular momentum conservation and moment of inertia.
3. Acquire knowledge elementary particles and the nature of interaction between them.

Prerequisites: Basic knowledge of mechanics, properties of matter and mathematical tools.

Module I

Elasticity (13 hours)

Basic ideas on elasticity – Young's modulus- bulk modulus-rigidity modulus-Poisson's ratio-Work done per unit volume- Bending of beams- uniform and non-uniform bending-bending moment-flexural rigidity-Young's modulus–cantilever method- Twisting couple- torsional rigidity- determination of rigidity modulus using static and dynamic methods.

Text Book: Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)

Module II

Rotational Dynamics of Rigid Bodies (10 hours)

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

Text Book: Mechanics- H.S. Hans and S.P. Puri. (Tata McGraw-Hill)

Module III

Oscillations (7 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.

Text Book: Mechanics- H.S. Hans and S.P. Puri. (Tata McGraw-Hill)

Particle Physics **(6 hours)**

Fundamental interactions in nature- gauge particles- classification of particles-antiparticles- elementary particle quantum numbers- conservation laws- quark model (qualitative)

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

Reference:

1. Mechanics- H.S. Hans and S.P.Puri. (Tata McGraw-Hill)
2. Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)
3. Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)

SEMESTER II

BDPC202: ELECTRIC AND MAGNETIC PHENOMENA, THERMODYNAMICS, ERROR ANALYSIS AND EXPERIMENTAL METHODS

Credit: 2

Total Hours: 36

Course Objective:

1. Give an introduction to error analysis and experimental methods.
2. Brief description about the basics of thermodynamics
3. Introduce various electric and magnetic phenomena

Course Outcome:

1. Understand the theory behind the origin of magnetism and some important magnetic properties observed in nature.
2. Study the fundamental laws of thermodynamics, its underlying concepts and its consequences.
3. To get some basic idea about error analysis, propagation of errors and to estimate uncertainties in measurements.

Prerequisites: Basic knowledge of electricity, magnetism, heat, thermodynamics, and mathematical tools.

Module I

Dielectric and Magnetic Properties of Solids (12 hours)

Review of Basic Equations - Dielectric Constant - Dipole Moment-Polarizability-Clausius-Mosotti Relation- Ferrroelectricity - Classification of Magnetic Materials-Langevin's theory - Paramagmetism - Curie-Weiss Law- Curie temperature - Antiferromagnetism and Ferrimagnetism – Magnetisation - Magnetic Domain Structure – Spintronics - Spin Waves.

Text Book: Elementary Solid State Physics: Ali Omar (Pearson)

Module II

Thermodynamics (12 hours)

Thermodynamic systems- thermodynamic equilibrium- thermodynamic processes- isothermal process- adiabatic process- zeroth law of thermodynamicsfirst law of thermodynamics- heat engine- the Carnot engine- refrigeratorconcept of entropy- second law of thermodynamics- third law of thermodynamics

Text Book: Heat and Thermodynamics- Brijlal and Subrahmanyam (S. Chand &Co)

Module III

Error Analysis and Experimental Methods (12 hours)

Basic ideas– uncertainties – dominant errors – random errors – systematic errors- estimating and reporting errors- best estimate- significant figures– absolute and relative errors - standard deviation – error bars and graphical representation- checking relationships with a graph, Propagation of errors – sum and differences – products and quotients – powers- multiplying by constants. Independent uncertainties in sum and product. Least count of instruments- electrical measurement - working principle of galvanometer, voltmeter, ammeter and digital multimeter.

Text Book: An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, John R. Taylor - Univ. Science Books

Reference:

1. Introduction to Modern Physics- H.S. Mani and G.K. Mehta
2. Elementary Solid State Physics: Ali Omar (Pearson)
3. Solid State Physics, P.K. Palanisamy, Scitech publications
4. Solid State Physics, R.K Puri & V.K. Babber, S. Chand
5. Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)
6. Modern Physics- R. Murugeshan (S. Chand and Co.)
7. Introduction of Electrodynamics- D.J. Griffiths (PHI Pvt. Ltd)
8. Modern Physics- G.Aruldas and P. Rajagopal (PHI Pub)
9. Thermodynamics- Zemansky and Dittmann (Tata McGraw-Hill)
10. Heat and Thermodynamics- Brijlal and Subrahmanyam (S. Chand &Co)
11. An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, John R. Taylor - Univ. Science Books

SEMESTER III

BDPC303: QUANTUM MECHANICS, SPECTROSCOPY, NUCLEAR PHYSICS AND BIOLOGICAL EFFECTS OF RADIATION AND NUCLEAR MEDICINE

Credit: 3

Total Hours: 54

Course Objective:

1. Brief introduction to spectroscopy and nuclear physics
2. Description of basic ideas of quantum mechanics

Course Outcome:

1. Study the need for quantum approach and the foundations of quantum theory.
2. Study different models of atom and explain the atomic spectra.
3. Study atomic nucleus, stability of nucleus, decay of nucleus and its applications.
4. Study effects of radiation in living organisms and its application in modern medicine.

Prerequisites: Basic knowledge of modern physics, atomic nuclei, electronics and mathematical tools.

Module I

Elementary Quantum Theory **(12 hours)**

Introduction- black body radiation and Planck's quantum hypothesis-photoelectric effect-Einstein's explanation- de Broglie hypothesis- matter wave- Davisson-Germer experiment-uncertainty principle (derivation not expected) -wave function- conditions-normalization-Schroedinger equation-stationary states- non-normalizable wave functions- box normalization

Text Books:

Introduction to Modern Physics- H.S. Mani and G.K. Mehta

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

Modern Physics- R. Murugeshan (S. Chand and Co.)

Quantum Physics- S. Gasiorowicz (John Wiley & Sons)

Spectroscopy **(12 hours)**

Atom models- Thomson's model-Rutherford's nuclear atom model-Bohr atom model-Somerfield's relativistic atom model- vector atom model- Fine structure of Hydrogen atom -

Rotational and vibrational spectra of rigid diatomic molecules- Raman effect-quantum theory.

Text Books:

Introduction to Modern Physics- H.S. Mani and G.K. Mehta

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

Modern Physics- R. Murugeshan (S. Chand and Co.)

Quantum Physics- S. Gasiorowicz (John Wiley & Sons)

Module II

Atomic Nucleus and Radioactivity (12 hours)

Nuclear constituents- different nuclear types- properties of nuclei- size- mass charge- density- binding energy- packing fraction -nuclear stability -spin - magnetic dipole moment -electric quadrupole moment -properties of nuclear forces -radioactivity- radiations -law of radioactive decay - half life- mean life-radioactivity units -radioactive series-radioactive dating- carbon dating-artificial radioactivity

Text Books:

Introduction to Modern Physics- H.S. Mani and G.K. Mehta

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

Modern Physics- R. Murugeshan (S. Chand and Co.)

Quantum Physics- S. Gasiorowicz (John Wiley & Sons)

Nuclear Fission and Fusion (7 hours)

Nuclear fission- energy release in fission reactions- liquid drop model of fission chain reaction- nuclear reactor- power and breeder reactor- atom bomb nuclear fusion- energy production in stars- thermonuclear reactions in sun- p-p chain - C-N cycle

Text Book: Nuclear Physics, Principles and applications-John Lilley, Wiely 2006

Module III

Biological Effects of Radiation and Nuclear Medicine (11hours)

Direct and indirect physical damage - Indirect chemical damage - Dose, Dose Rate and dose distribution- Damage to critical tissues - Human exposure to radiation - Risk assessment

Nuclear medicine: Projection imaging: X-Radiography and the Gamma Camera- Positron emission tomography - Magnetic resonance imaging - Radiation therapy

Text Book: Nuclear Physics, Principles and applications-John Lilley, Wiley 2006

Reference:

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. Quantum Physics- S. Gasiorowicz (John Wiley & Sons)
5. Basic electronics- B. L. Theraja (S. Chand and Co.)
6. Elements of electronics- M.K. Bagde, S.P. Sngh and K. Singh (S. Chand and Co.)
7. Modern Physics- G. Aruldas and P. Rajagopal (PHI Pub)
8. Digital principles and applications- A. P. Malvino and P. Leach
9. Nuclear Physics, Principles and applications-John Lilley, Wiely

SEMESTER IV

BDPC404: PHYSICAL OPTICS, LASER PHYSICS AND SUPERCONDUCTIVITY

Credit: 3

Total Hours: 54

Course Objective:

1. Brief introduction to physical optics and laser physics
2. Develop a basic knowledge in superconductivity

Course Outcome:

1. Study theory of interference, diffraction, polarization and some applications.
2. Understand the idea behind stimulated emission, Lasers, types of Lasers and their applications.
3. Study properties and life cycle of stars qualitatively.

Prerequisites: Basic knowledge of optics and mathematical tools.

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- interference in thin films

Text Books:

A text book of optics- N. Subrahmanyam, Brijlal and M.N. Avadhanulu

Optics- Satyaprakash (Ratan prakash Mandir)

Optics- A. Ghatak (Tata McGraw-Hill)

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) –resolving power- dispersive power

Text Books:

A text book of optics- N. Subrahmanyam, Brijlal and M.N. Avadhanulu

Optics- Satyaprakash (Ratan prakash Mandir)

Optics- A. Ghatak (Tata McGraw-Hill)

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 – double refraction- 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 Books:

A text book of optics- N. Subrahmanyam, Brijlal and M.N. Avadhanulu

Optics- Satyaprakash (Ratan prakash Mandir)

Optics- A. Ghatak (Tata McGraw-Hill)

Module III

Laser Physics **(10 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-Neodymiun YAG laser- He-Ne laser- Properties of laser beams- Application of laser beams

Text Books:

A text book of optics- N. Subrahmanyam, Brijlal and M.N. Avadhanulu

Optics- Satyaprakash (Ratan prakash Mandir)

Optics- A. Ghatak (Tata McGraw-Hill)

Superconductivity **(9 hours)**

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

Text Books:

Solid State Physics- R. K. Puri and V.K. Babbar (S. Chand and Co.)

Reference:

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. A text book of optics- N. Subrahmanyam, Brijlal and M.N. Avadhanulu (S. Chand and Co.)
5. Optics- Satyaprakash (Ratan prakash Mandir)
6. Modern Physics- G. Aruldas and P. Rajagopal (PHI Pub)
7. Solid State Physics- R. K. Puri and V.K. Babbar (S. Chand and Co.)
8. Optics- A. Ghatak (Tata McGraw-Hill)

PRACTICAL

Minimum of experiments to be done in each course is 14.

Minimum number of experiments for appearing practical examination is 8.

SEMESTER I & II

BDPC2P01: PROPERTIES OF MATTER, MECHANICS AND MAGNETIC PHENOMENA

Credit: 2

Total Hours: 72

1. Vernier Calipers -- Volume of cylinder (solid and hollow), sphere.
2. Screw gauge – Radius of wire, volume of sphere and glass piece
3. Beam balance - Mass of a solid (sensibility method)
4. Spectrometer – Angle of the Prism
5. Hare's Apparatus, U Tube – density of liquids
6. Spectrometer - Refractive Index of material of prism.
7. Diode characteristics- ac and dc resistance
8. Coefficient of viscosity of the liquid – Constant Pressure head method
9. Coefficient of viscosity Variable Pressure head method
10. Surface Tension – Capillary rise method
11. Determination of Young's Modulus- Cantilever (Scale and Telescope)
12. Characteristics of Zener diode
13. Fly wheel – Moment of Inertia
14. Torsion pendulum -Rigidity modulus
15. Determination of moment of inertia of rotationally symmetric body (solid sphere **OR** cylinder **OR** disc) from their period of oscillation on a torsion axle
16. Spring constant - Hooke's law - oscillation
17. Resistivity of the material of the wire- Ohm's law and verification by multimeter
18. Construction of half wave rectifier with and without filter – Ripple factor
19. Laser- Transmission **OR** Reflection Grating- Determination of wavelength
20. Liquid lens – optical constants of a lens
21. Poisson's ratio of rubber
22. Symmetric Compound pendulum – Acceleration due to gravity

23. Temperature dependence of capacitance- polymer and ceramic capacitors.
24. Potentiometer – standardization
25. Gates – AND, OR, NOT- verification of truth tables

SEMESTER III & IV

BDPC4P02: SPECTROSCOPY, NUCLEAR PHYSICS, BASIC ELECTRONICS

Credit: 2

Total Hours: 72

1. Determination of Young's Modulus- Cantilever (Pin & Microscope)
2. Determination of Youngs Modulus – Non-Uniform bending (Scale & Telescope)
3. Asymmetric Compound Pendulum- Determination of moment of inertia and Acceleration due to gravity (g)
4. Symmetric Compound Pendulum - Determination of Radius of gyration and moment of inertia
5. Torsion pendulum (Equal mass method) - Rigidity modulus and Moment of Inertia
6. Spectrometer – Dispersive power of prism
7. Spectrometer – Grating - wavelengths
8. Newton's rings -Wave length
9. Conversion of Galvanometer into voltmeter
10. Carey Foster's Bridge -Measurement of resistivity
11. Tangent Galvanometer – Ammeter calibration
12. Potentiometer-Calibration of low range ammeter
13. Potentiometer – Resistance of a wire
14. Construction of full wave rectifier (center-tap) with and without filter – Ripple factor
15. Construction of regulated power supply using Zener diode- line and load regulation
16. Laser diffraction- width of single slit **OR** thickness of wire
17. Refractive index of liquid- Liquid Lens
18. Air wedge-thickness of wire
19. Static Torsion - Rigidity modulus
20. Deflection and Vibration Magnetometer-m & Bh
21. Field along the axis of circular coil- determination of Bh
22. Searle's Vibration Magnetometer - magnetic moment
23. Resistance of a galvanometer and its figure of merit

References

1. Practical Physics – C L Arora- S Chand

2. Properties of Matter -D.S. Mathur
3. Optics -Subrahmanyam& Brijlal
4. Electricity &Magnetism -Sreevastava
5. Electronics Lab Manual (Vol.1) -K. A. Navas
6. Laboratory manual for electronic devices and circuits-David A Bell
7. Practical Physics- Joseph Ittiavirah, Premnath and Abraham

OPEN COURSES

BOPH501: PHYSICS IN DAILY LIFE

Credit: 3

Total Hours: 54

Course Objective:

1. Provide a qualitative description of basic laws in physics
2. Give a qualitative description for many natural phenomena using fundamental laws in physics

Course Outcome:

3. Observe the physical world with a new approach
4. Understand the everything around them relating with simple laws in physics
5. Calculate or predict several phenomena with an innovative way.
6. Understand about the several phenomena related to optics and sound

Perquisites: School level knowledge in Physics

Module I

Motion and Waves **(18 hours)**

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

Work-power-kinetic energy-potential energy-conservation of energy- machines. Rotational motion, Moment of inertia, torque, centripetal and centrifugal acceleration examples- banking of curves, centrifugal pump, roller coasters. Waves – transverse and longitudinal waves, sound waves, Doppler Effect.

Module II

Light **(18 hours)**

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

Total internal reflection, mirage, sparkling of diamond, primary and secondary rainbow – optical fibers. Concave and convex mirrors, lenses – focal length, power of a lens, refractive index, prism, dispersion. Human eye, defects of the eye – myopia, hypermetropia, presbyopia and astigmatism and their correction by lens.

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

Module III

Electricity and Energy **(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.

Fluids and Heat **(8 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

References

1. Fundamentals of Physics with Applications by Arthur Beiser, TMH
2. Conceptual Physics by Paul G Hewitt, Pearson

BOPH502: INTRODUCTION TO ASTRONOMY AND COSMOLOGY

Credit: 3

Total Hours: 54

Course Objective:

1. Understand theories about the origin, evolution and fate of universe

Course Outcome:

1. The student will be able to develop a scientific attitude towards the cosmos we live in.
2. To understand some basic facts about the solar system, Sun and other planets in the solar system.
3. To have a basic idea about the properties, evolution and fate of various types of stars in the universe.

Prerequisites: This course in intended for the students of other disciplines. So a secondary level knowledge of mathematics and physics is enough to study this course. But an inquisitive mind and curiosity are essential from the part of a student.

Module I

Our Solar System – The Sun and Planets (18 hours)

Copernican theory of the solar system, The celestial sphere and stellar magnitudes, The celestial coordinate system, The formation of the solar system.

The Sun, Nuclear fusion-The proton–proton cycle, The solar neutrino problem, The solar atmosphere: photosphere, chromosphere and corona, The solar wind, The sun's magnetic field and the sunspot cycle, Prominences, flares and the interaction of the solar wind with the earth's atmosphere, Solar eclipses.

Planets, Planetary properties, Planetary atmospheres , The planets of the solar system, minor planets and dwarf planets, Comets, Extra-solar planets – discovery.

Text Book: Introduction to astronomy and cosmology - Ian Morison Chapter 1, 2, 3 & 4 (John Wiley & Sons)

Module II

The Life and Death of Stars (18 hours)

Stellar luminosity, Stellar distances, Proper motion, The absolute magnitude scale, Colour and surface temperature, Stellar photometry, Stellar spectra, Spectroscopic parallax, The Hertzsprung–Russell Diagram, The size of stars, The masses and densities of stars, The stellar mass–luminosity relationship, Stellar lifetimes.

Low mass stars: 0.05–0.5 $M_\odot$, Mid mass stars: 0.5–8 $M_\odot$, High mass stars in the range >8 solar masses, Variable stars, The evolution of a sun-like star, White dwarfs, Evolution in

close binary systems – the Algol paradox, Type II supernova, Pulsars and Neutron stars, The discovery of pulsars, Black holes.

Text Book: Introduction to astronomy and cosmology - Ian Morison Chapter 5,6 & 7 (John Wiley & Sons)

Module III

The Origin and Evolution of the Universe (18 hours)

Big Bang models of the universe, The blue shifts and redshifts observed in the spectra of galaxies, The expansion of the universe, The cosmic microwave background, Inflation, The formation of the primeval elements, The 'ripples' in the Cosmic Microwave Background, The components of Universe: dark matter and dark energy, The future of the universe.

A problem with age, the steady state model of the universe, A universe fit for intelligent life, Intelligent life in the universe.

Text Book: Introduction to astronomy and cosmology - Ian Morison Chapter 9 (John Wiley & Sons)

References:

1. Ian Morison, Introduction to astronomy and cosmology, John Wiley & Sons, UK, 2008
2. Ian Morison, A journey through the universe: Gresham lectures on astronomy, Cambridge University Press, UK, 2015.
3. Cesare Emiliani, Planet Earth, Cambridge University Press, UK, 1995.
4. Elements of cosmology, Jayant V Narliker. University Press 1998
5. Seven Wonders of cosmos, Jayant V Narliker, Cambridge University Press 1999

Additional Reading:

1. https://www.space.com/16014-astronomy.html
2. https://theplanets.org

BOPH503: RENEWABLE ENERGY

Credit: 3

Total Hours: 54

Course Objective:

1. Basic knowledge about current energy scenario.
2. Basic knowledge about conventional and nonconventional energy sources

Course Outcome:

1. Develop basic concepts about Energy production, Renewable Energy sources and Sustainable development etc
2. Awareness about the challenging energy crisis we have to face in future.
3. Awareness about the necessity of conserving fossil fuels.

Prerequisites: Basic knowledge in science.

Module I

Introduction to Energy Sources **(18 hours)**

Different classifications of energy resources and examples - non- renewable energy sources:- coal, oil, natural gas – their merits and demerits - reserves and production of petroleum and natural gas in India - hydro-electric energy - nuclear energy – nonconventional energy sources: Introductory or qualitative ideas about solar energy, wind energy, energy from biomass and biogas, geothermal energy, ocean tidal energy, ocean wave energy, ocean thermal energy conversion (OTEC) system, their merits and demerits – advantages and disadvantages of renewable energy sources.

Text Book: Non-Conventional Energy Resources and Utilisation (Energy Engineering), Er. R K Rajput (S Chand & Co.) – Chapter 1.

Module II

Solar Thermal Energy **(10 hours)**

Sun as a source of energy – measurement of solar radiation: pyranometer, pyrheliometer, sunshine recorder (qualitative ideas only) - solar thermal energy collection-collectors in various ranges and applications – flat plate collectors: various designs, applications, advantages and disadvantages - concentrating collectors: various designs - solar water heating - solar heating of buildings - solar cooling of buildings - solar distillation – solar drying – solar cooking – solar thermal power plants.

Solar Photovoltaic Systems **(8 hours)**

Qualitative ideas of semiconductors and photovoltaic effect – solar photovoltaic cells – classification of solar cells – silicon cell modules – photovoltaic (PV) systems – advantages and disadvantages – water pumping systems – SPV lighting systems - PV integration.

Text Book: Non-Conventional Energy Resources and Utilisation (Energy Engineering), Er. R K Rajput (S Chand & Co.) – Chapters 2, 3 & 4.

Module III

Wind Energy **(10 hours)**

Origin of wind – wind availability and measurement – basic principle of wind energy conversion and wind power – components of a wind energy conversion system – advantages and disadvantages of wind energy conversion systems – site selection for wind energy conversion systems – classification of wind mills/machines – wind-electric generating power plant - environmental impacts of wind energy conversion systems.

Text Book: Non-Conventional Energy Resources and Utilisation (Energy Engineering), Er. R K Rajput (S Chand & Co.) – Chapter 5.

Biomass Energy **(8 hours)**

Introduction to biomass - biomass resources – energy plantations - biomass conversion processes – methods to obtain energy from biomass – biomass gasification – energy recovery from urban waste and wood - biogas: advantages and applications – biogas plants: different designs and classification – power generation from landfill gas – biodiesel.

Text Book: Non-Conventional Energy Resources and Utilisation (Energy Engineering), Er. R K Rajput (S Chand & Co.) – Chapter 6.

References:

1. Non – Conventional Energy Sources: G D Rai (Khanna Publishers)
2. Renewable energy-Power for a sustainable future, Godfrey Boyle (Oxford university press
3. Renewable Energy Technologies: Solanki C S (Prentice-hall Of India Pvt Ltd)
4. Renewable Energy Sources & Their Environmetal Impact : Abbasi (Prentice-hall of India Pvt Ltd)
5. Renewable Energy Sources for Sustainable Development N.S. Rathore, N.L. Panwar (New India Publishing Agency)
6. Renewable Energy : Ulrich Laumanns And Dieter Uh Dirk Abmann (James & James Science Publishers)
7. Understanding Renewable Energy Systems : Volker Quaschning (James & James Science Publishers)
8. Renewable Energy: Global Perspectives : Azmal Hussain (Icfai University Press)
9. New And Renewable Energy Technologies For Sustainable Development : Naim Hamdia Afgan, Da Graca Carvalho Maria, Maria Da Graca Carvalho (Taylor & Francis Group)

10. Renewable Energy from the Ocean : Avery, William H.; Wu, Chih; Craven, John P. (Oxford University Press)
11. Fundamentals of Renewable Energy Systems : Mukherjee D (New Age International (p) Limited)
12. Renewable Energy Sources & Emerging Tech., : Kothari D P (Prentice-hall Of India Pvt Ltd)
13. Energy From Biomass : Willeke Palz, D. Pirrwitz (Springer)
14. Understanding Renewable Energy Systems : Volker Quaschning (James & James Science Publishers)
15. Ocean, Tidal, And Wave Energy: Power From The Sea : Lynn Peppas (Crabtree Publishing Company)

ADD ON COURSES

BPHEX01: ELECTRONIC AND ELECTRICAL EQUIPMENT MAINTENANCE

Credit: 2

Total Hours: 36

Course Description and objectives

This course will introduce students to the art and science of building and maintaining electronic and electrical equipments and circuits. This is an introductory course for students aimed at developing their ability in handling electronic and electrical equipments. The course is lab-oriented and hence students will have the opportunity to have hands-on training in electrical and electronics equipment maintenance and repairing. There are no pre-requisites as the course build up from rudimentary ideas through simple experiments.

By the end of the course the students are expected to

(1) be able construct simple electronic devices

(2) be able to repair simple electrical devices

(3) be able to make repair simple electronic devices

(4) be able to design simple electrical connections

(5) be able to build simple electrical circuits and connections

(6) be able to measure different parameters of electrical and electronic device and circuits using measuring devices

(7) be able to identify and select suitable electrical and electronic equipments for different circuits and devices

Module I **(18 hours)**

Fundamentals of Electrical and Electronics

Basic concept of Electricity- Ohm's law, Kirchhoff's laws. Resistors – symbols, different types of resistors used in Electrical and Electronic circuits, Specification of resistance and tolerance, effect of variation of temperature on resistance, measurement of resistance using multimeters. Inductors- general information – symbol, types of inductors, construction, specification and applications, self and mutual inductions, series and parallel combinations. Transformers, working principle of transformers, step up and step down transformers, parts of transformers. Capacitors- capacitance and capacitive reactance, types of capacitors, specification and applications, significance of series and parallel connection of capacitors,

measurement of capacitance. Basic Electronics – semiconductors, properties of semiconductors, different types, PN junction diode, forward and reverse biasing. Rectifier configurations – half wave and full wave bridge rectifier. Filter circuits and components. Transistor, types of transistors, construction and working. IC used in electronic circuits, bread board. Signal generator, study of CRO, Specification and block diagram, familiarisation with front panel and controls of CRO.

Module II **(18 hours)**

House wiring and Installation of Equipments, Assembling and Maintenance of Household Electrical Equipments

Electrical wiring – basic ideas, types of wiring- domestic and industrial. Specification of wiring, grading of cables and current rating. Switches, cables, electrical fittings, bulbs and plugs. Fan with individual switches, two way switches. Testing of connection of single phase wiring and three phase wiring. Different types of loads, earthing, power consumption general information. Methods to reduce power consumption. ELCB(Earth Leakage Circuit Breaker), MCB(Miniature Circuit Breaker), single tube connection, double tube connection

Regulated power supply, computers – familiarisation of input and output devices.

Assembling of household electric equipments – Iron box, heater, mixer and fan

References

1. A Text Book of Electronic Circuits – RS Sedha – S Chand Publishers
2. Electronic Principles – Malvino – Tata Mc Graw Hill
3. Wiring Simplified – H P Ritcher et al – Park Publications

Question Paper Pattern for Written Examination (Time: 2 hrs)

Type of questions and marks for each question	Number of questions	Number of questions to be answered	Mark for each section
Section A Very short answer type questions (2 marks)	5	5	10
Section B Short answer type questions (5 marks)	6	4	20
Section C Essay type questions (10 marks)	4	2	20
		Grand Total	**50**

BPHEX02: INTRODUCTION TO MATLAB

Credit: 2

Total Hours: 36

Course Description and Objectives

This course will introduce students to computer programming and problem solving using Matlab. It is an introductory course for students aimed at developing their skill in scientific computing. Matlab is a language designed especially for processing, evaluating and graphical displaying of numerical data. The class is lab-focused, so students will spend much more time doing hands-on exercises in the computer lab. There are no maths or programming prerequisites; however elementary skills in computer science will be an advantage.

By the end of the course students are expected to: • Be able to write simple computer programs in Matlab • Apply the skills to evaluate scientific problems • Understand basic concepts in computer science • Learn data structures (such as strings, matrices and arrays), data manipulation and presentation (loading data files, computing simple statistics and graphing data), and basic programming techniques.

Module I **(18 hours)**

Introduction to MATLAB; Basics of MATLAB: windows - input & output - platform dependence - file types - general commands

Script Files; Function files: Functions – Sub functions; Global Variables, Loops, Branches and control-flow

Tutorials: Basics - Creating and working with arrays - Creating and Printing simple plots - Creating, saving and executing a script - Creating and executing a function file - Working with arrays and matrices - Importing and Exporting data - Files and Directories - Publishing reports

Module II **(18 hours)**

Graphics; Plotting simple graphs; Basic 2D plots: Style Options – Labels, title and legend – Axis Control, zoom in and zoom out – Using plot editor - Overlay plots – Specialized 2D Plots; Examples: fplot – semilogx – semilogy – loglog – fill – bar – barh – area – pie – hist – stem – stairs – compass – comet – pcolor; subplots

3D plots; View: view(2) and view(3) with examples; Mesh and surface plots; Examples: plot3 – fill3 – surf – surfc -surf1 – meshz – waterfall – pie3 – stem3

References

1. Getting started with MATLAB- Rudra Pratap, Oxford University Press.
2. Mastering MATLAB 7- Duane Hanselma and Bruce Littlefield, Pearson Education.
3. Understanding MATLAB- S N Alam, I K International Publishing House.
4. Programming in MATLAB- Patel and Mittal, Pearson Education India
5. Web resource: www.mathworks.com

Question Paper Pattern for Written Examination (Time: 2 hrs)

Mark Distribution			**Marks**
Part A	5/5	5 × 2	10
Part B	4/6	4 × 5	20
Part C	2/4	2 × 10	20
		Grand Total	**50**

St Berchmans College

Founded 1922

AUTONOMOUS | College with Potential for Excellence | Reaccredited by NAAC with A Grade

Affiliated to Mahatma Gandhi University, Kottayam, Kerala

Changanassery, Kottayam, Kerala, India-686101