SACRED HEART COLLEGE (AUTONOMOUS), THEVARA
KOCHI, KERALA, 682013

CURRICULUMAND SYLLABI

CHOICE BASED COURSECREDIT AND SEMESTER SYSTEM

(CBCSS)

B.Sc. Physics PROGRAMME

INTRODUCED FROM 2015 ADMISSION ONWARDS

BOARD OF STUDIES IN PHYSICS

Sacred Heart College, Thevara, Kochi, Kerala

Report of the Board of Studies

Board of studies meeting was held on Nov. 1, 2014.

- ✓ A total of 14 members were present including all the nominated members from outside.

Prof. George Philip – *HoD*

Dr. Georgekutty Joseph (*Chairman*, BOS)

Prof. (Dr.) N.V. Unnikrishnan (M.G.University, VC Nominee)

Dr. Joechan Joseph (S.A.College, Edathua)

Dr. PramodGopinath (IIST, Trivandrum)

Dr. Ison V Vanchipurackal (St.Thomas College, Pala)

Mr. Kuruvilla George (Industrialist, Ernakulam)

Dr. Siby Mathew

Prof. George V.M

Prof. Alex ShinuScaria

Dr. Roby Cherian

Dr. Jimmy Sebastian

Dr. Sumod.S.G. (*Secretary*, BOS)

- ✓ Approved the panel for the Examiners for both UG and PG programmes.
- ✓ Modified the components in the distribution of marks in Internal Continuous evaluation scheme. The two conventional assignments in the present scenario will be modified with one assignment as Open book/Open library Tests. The other one will still remain as such, but will be focused only on solving physics problems, which will be different for different students.
- ✓ Modified and approved the question paper pattern for PG in such a way as to help the students to win many competitive examinations such as GATE/NET/JEST etc.

- ✓ Proposal for a new Mphil course was discussed and approved. The syllabus, scheme and other activities such as making MoUs with the other research labs/universities etc. were discussed in detail. A committee was selected from the Board of Studies (BOS) with Dr. Georgekutty Joseph as the Chairman.
- ✓ Separate committees were formed for both UG and PG programmes for making necessary modifications in the existing scheme/syllabus, if any with Prof. George Philip and Prof. (Dr.) N.V.Unnikrishnan as the respective chairpersons.
- ✓ 'Skill-development' was introduced in the curriculum as a separate component for both UG and PG programmes. This will promote the students to come out with originality of thoughts/creativity and ability of making independent decisions. As an initial step, for the UG students, the revival of 'Home Tech' programme along with introducing hobbies like amateur radio was suggested.
- ✓ Decided to promote the students to use tools in the advanced technology in the field of science, such as introducing new software packages such as Origin, Matlabetc during lab activities.
- ✓ Identified conveners to conduct the International Seminar, Refresher course (Academy of Science) and Space Science Exhibition (ISRO) at our institution.
- ✓ Decided to promote UG level students to design new instruments, use Virtual labs, Phenix etc.
- ✓ After making the necessary decisions, a common mail will be circulated among the members of BOS.
- ✓ The meeting came to an end at 01:15 pm.

CONTENTS

1

CURRICULUM

1.1 SCOPE

Applicable to all regular Under Graduate Programmes conducted by the Sacred Heart College (Autonomous) with effect from 2015-16 admissions.

1.2 STUDENT ATTRIBUTES

The important student attributes including appreciation of the physical world and the discipline of Physics, curiosity, creativity and reasoned skepticism and understanding links of Physics to other disciplines and to societal issues should gave encouragement. With this in mind, we aim to provide a firm foundation in every aspect of Physics and to explain a broad spectrum of modern trends in physics and to develop experimental, computational and mathematics skills of students. The course also aims to develop the following abilities:

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

(Please add student attributes)

1.3 DEFINITION.

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

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

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

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

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

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

1.3.8. ***'Open course'*** means a course outside the field of his/her specialization, which can be opted by a student.

1.3.9. ***'Additional core course'***means a compulsory course for all under graduate students (as perthe UGC directive) to enrich their general awareness.

1.3.10. ***'Additional Course'***is acourse registered by a student over and above the minimum

required courses.

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

1.3.12. ***'Additional credit'*** is the numerical value assigned to Club activities, Social service, Internship etc. which is not added with the total academic credits of the students.

1.3.13. '***Internship'*** is job training for professional careers.

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

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

1.3.16.*'Parent Department'* means the department which offers core courses within a degree programme.

1.3.17. **'*Department Council'*** means the body of all teachers of a department in a college.

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

1.3.19. '*Faculty Advisor'* means a teacher from the parent department nominated by the Department Council, who will advise the student in the choice of his/her courses and other academic matters.

1.3.20. Grace Marks shall be awarded to candidates as per the University Orders issued from

time to time.

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

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

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

1.4. DURATION

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

The duration of odd semesters shall be from **June to October** and that of even semesters from **November to March.**

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

1.5. **REGISTRATION**

The strength of students for each course shall remain as per existing regulations, except in case of open courses for which there shall be aminimum of 15 and maximum of 75 students per batch, subject to a marginal increase of 10. For non-core compulsory courses the student strength shall be decided by the Academic Council of the College from time to time.

Those students who possess the required minimum attendance and progress during a semester and could not register for the semester examination are permitted to apply for Notional Registration to the examinations concerned enabling them to get promoted to the next semester

1.6. SCHEME AND COURSES

SCHEME: CORE COURSES (COMMON FOR THE PROGRAMME)

Semester	CODE	NAME OF CORE COURSE	INST. HRS/WEEK	CREDIT	TOTAL CREDITS	TOTAL HOURS/SEMESTER	UNIVERSITY EXAM	Weightage	
								IA	EA
1	**15U1CRPHY 01**	Methodology in Physics *PRACTICAL 1	2 2	2 1	3	72	3 HRS	1	3
2	**15U2CRPHY 02**	Mechanics and Properties of Matter *PRACTICAL 2	2 2	2 1	3	72	3	1	3
	15U2ACENVI	Additional Core Course-Environmental Studies	5	4	4	90	3	1	3
3	**15U3CRPHY 03**	Electronics *PRACTICAL 3	3 2	3 1	4	90	3	1	3
4	**15U4CRPHY 04**	Electricity and Electrodynamics *PRACTICAL 4	3 2	3 1	4	90	3	1	3
5	**15U5CRPHY 05**	Classical and Quantum Mechanics *PRACTICAL 5	3 2	3 1	4	90	3	1	3
	15U5CRPHY 06	Physical Optics and Photonics *PRACTICAL 6	3 2	3 1	4	90	3	1	3
	15U5CRPHY 07	Thermal and Statistical Physics *PRACTICAL 7	3 2	3 1	4	90	3	1	3
	15U5CRPHY 08	Digital Electronics *PRACTICAL 8	3 2	3 1	4	90	3	1	3
	15U5OCPHY 1	Energy and Environmental Studies	3	3	3	54	3	1	3
		Core Course-Field Study, Study Tour and Group Activity	1	0	0	18	-	1	3
6	**15U6CRPHY 09**	Computational Physics *PRACTIAL 9	3 2	3 1	4	90	3	1	3
	15U6CRPHY 10	Nuclear and Particle Physics *PRACTICAL 10	3 2	3 1	4	90	3	1	3
	15U6CRPHY 11	Condensed Matter Physics *PRACTICAL 11	3 2	3 1	4	90	3	1	3
	15U6CRPHY 12	Relativity and Spectroscopy *PRACTICAL 12	3 2	3 1	4	90	3	1	3
	15U6CRPHY 13	Optoelectronics	5	4	4	90	3	1	3
		Project	1	1	1	18	-	1	3

SCHEME: COMPLEMENTARY COURSES

1. PHYSICS FOR MATHEMATICS MAIN

Semester	CODE	NAME OF CORE COURSE	INST. HRS/ WEEK	CREDIT	TOTAL CREDITS	TOTAL HOURS /SEMESTER	UNIVERSITY EXAM	Weightage	
								IA	EA
1	**15U1CPPHY01**	Properties of matter, Mechanics and Fourier Analysis *PRACTICAL 1	2 2	2 1	3	72	3 HRS	1	3
2	**15U2CPPHY03**	Electric and Magnetic Phenomena, Thermodynamics and Special Theory of Relativity *PRACTICAL 2	2 2	2 1	3	72	3	1	3
3	**15U3CPPHY05**	Quantum Mechanics, Spectroscopy, Nuclear Physics, Basic Electronics and Digital Electronics *PRACTICAL 3	3 2	3 1	4	90	3	1	3
4	**15U4CPPHY07**	Physical Optics, Laser Physics and Astrophysics *PRACTICAL 4	3 2	3 1	4	90	3	1	3

2. PHYSICS FOR CHEMISTRY MAIN

Semester	CODE	NAME OF CORE COURSE	INST. HRS/ WEEK	CREDIT	TOTAL CREDITS	TOTAL HOURS /SEMESTER	UNIVERSITY EXAM	Weightage	
								IA	EA
1	**15U1CPPHY02**	Properties of matter, Mechanics and Particle Physics *PRACTICAL 1	2 2	2 1	3	72	3 HRS	1	3
2	**15U2CPPHY04**	Electric and Magnetic Phenomena, Thermodynamics and Elementary Solid State Physics *PRACTICAL 2	2 2	2 1	3	72	3	1	3
3	**15U3CPPHY06**	Quantum Mechanics, Spectroscopy, Nuclear Physics and Electronics *PRACTICAL 3	3 2	3 1	4	90	3	1	3
4	**15U4CPPHY08**	Physical Optics, Laser Physics and Superconductivity *PRACTICAL 4	3 2	3 1	4	90	3	1	3

The U.G. programmes shall include (a) Common courses I & II, (b) Core courses, (c) Complementary Courses, (d) Open Course (e) Additional core course. (f) Study tour (g) Internship for English copy editor.

I) Additional credit components

(a) Talent & career club activity (optional)

(b) Social service (mandatory)

(c) Internship for Commerce, Communication and Computer applications (mandatory).

(d) Internship (desirable for other programmes).

1.7. PROGRAMME STRUCTURE FOR MODEL-I

A	Programme Duration	6 Semesters
B	Minimum credits required from common courses	38
C	Minimum credits required from Core + complementary + vocational* courses including Project	79
D	Minimum credits required from Open course	03
E	Additional core course (Environmental studies)	04
	Total Credits required for successful completion of the programme	124
F	Club activity (desirable)	01
G	Social service (mandatory)	01
H	Internship (desirable)	02
I	Minimum attendance required	75%

1.8. EXAMINATIONS.

The evaluation of each course shall contain two parts:

(i) CONTINUOUS INTERNAL ASSESSMENT (CIA)

(ii) END-SEMESTER EXAMINATION (ESE)

The internal to external assessment ratio shall be 1:3, for both courses with or without practical. There shall be a maximum of 75 marks for external evaluation and maximum of 25 marks for internal evaluation.

1.9. Computation of Grade and Grade points.

For all courses (theory & practical), grades are given on a 07-point scale based on the total percentage of marks. ***(CIA+ESE)*** as given below

Percentage of Marks	**Grade**	**Grade Point**
90 and above	A+ - Outstanding	10
80-89	A - Excellent	9
70-79	B - Very Good	8
60-69	C - Good	7
50-59	D - Satisfactory	6
40-49	E - Adequate	5
Below 40	F - Failure	0

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

1.9.1 Computation of SGPA

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses and the sum of the number of credits of all the courses undergone by a student in a semester.

SGPA (Si) = $\sum(C_i \times G_i) / \sum C_i$

Where$C_i$is the number of credits of the ith course and $G_i$is the grade point scored by the student in the ith course.

1.9.2 Computation of CGPA

i. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

CGPA = $\sum(Ci \times Si) / \sum Ci$

Where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.

Note: The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Illustration of Computation of SGPA and CGPA and Format for Transcripts

i. Computation of SGPA and CGPA

Illustrationfor **SGPA**

Course	**Credit**	**Grade letter**	**Grade point**	**Credit Point** (Credit x Grade
Course 1	3	B	8	3 X 8 = 24
Course 2	4	C	7	4 X 7 = 28

Course 3	3	D	6	3 X 6 = 18
Course 4	3	A^+	10	3 X 10 = 30
Course 5	3	E	5	3 X 5 = 15
Course 6	4	D	6	4 X 6 = 24
	20			139

Thus, **SGPA =139/20 =6.95**

Illustrationfor **CGPA**

Semester 1	**Semester 2**	**Semester 3**	**Semester 4**
Credit : 20 SGPA:6.9	Credit : 22 SGPA:7.8	Credit : 25 SGPA: 5.6	Credit : 26 SGPA:6.0
Semester 5	**Semester 6**		
Credit : 26 SGPA:6.3	Credit : 25 SGPA: 8.0		

Thus,

CGPA = $\frac{20*6.9+22*7.8+25*5.6+26*6+26*6.3+25*8}{144}$ **= 6.73**

Grades for the different semesters and overall programme are given based

On the corresponding SGPA/ CGPA as shown below:

SGPA/*CGPA*	**Grade**
Above 9	***A+ - Outstanding***
Above 8, but below or equal to 9	***A - Excellent***
Above 7, but below or equal to 8	***B -Very Good***
Above 6, but below or equal to 7	***C – Good***

Above 5, but below or equal to 6	***D – Satisfactory***
Above 4, but below or equal to 5	***E – Adequate***
4 or below	***F – Failure***

Note: A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 40% are required for a pass for a course.

For a pass in a programme, a separate minimum of Grade E is required for all the individual courses. If a candidate secures **F** Grade for any one of the courses offered in a Semester/Programme only **F** grade will be awarded for that Semester/Programme until he/she improves this to **E** grade or above within the permitted period. Candidate secure **E** grade and above will be eligible for higher studies.

1.10. Detailed Distribution of Courses

Semester I **Total Credits 20**

No	Course Title	Hrs/ Week	Credits
1	Common Course I English - 1	5	4
2	Common Course II English - 2	4	3
3	Common Course III Second Language - 1	4	4
4	Core Course I -	2	2
5	Core Course I Practical -	2	1
6	1st Complementary Course – Mathematics	4	3
7	2nd Complementary Course –I Chemistry	2	2
8	2nd Complementary Course Practicals- I	2	1
	Total	25 hrs	20

Semester 2 **Total Credits 20**

No	Course Title	Hrs/ Week	Credits
1	Common Course IV English 3	5	4
2	Common Course V English 4	4	3
3	Common Course VI Second Language -2	4	4
4	Core Course II	2	2
5	Core Course II Practical	2	1
6	1st Complementary Course II- Mathematics	4	3
7	2nd Complementary Course II - Chemistry	2	2
8	2nd Complementary Course II	2	1
	Total	25 hrs	20

Semester 3 **Total Credits 20**

No	Course Title	Hrs/ Week	Credits
1	Common Course VII English 5	5	4
2	Common Course VIII Second Language 3	5	4
3	Core Course III	3	3
4	Core Course III Practical	2	1
5	1st Complementary Course III	5	4
6	2nd Complementary Course III	3	3
7	2nd Complementary Course III Practicals III	2	1
	Total	25 hrs	20

Semester 4 **Total Credits 20**

No	Course Title	Hrs/ Week	Credits
1	Common Course IX English -6	5	4
2	Common Course X Second language 4	5	4
3	Core Course IV	3	3
4	Core Course IV Practical	2	1
5	1st Complementary Course IV - Mathematics	5	4
6	2nd Complementary Course IV - Chemistry	3	3
7	2nd Complementary Course IV Practicals.	2	1
	Total	25 hrs	20

Semester 5 **Total Credits 20**

No	Course Title	Hrs/ Week	Credits
1	Core Course V + Practical	3+2	3+2=5
2	Core Course VI + Practical	3+2	3+1=4
3	Core Course VII+Practical	3+2	3+1=4
4	Core Course VIII +Practical	3+2	3+1=4
5	Core Course Field Study , Study tour and Group activity (Credit 1 in 6th semester with investigatory project and visit to research institutes.)	1	
6	Open Course (For other streams)	4	3
	Total	25 hrs	20

Semester 6 **Total Credits 20**

No	Course Title	Hrs/ Week	Credits
1	Core Course IX+ Practical	3+2	3+1=4
2	Core Course X + Practical	3+2	3+1=4
3	Core Course XI + Practical	3+2	3+1=4
4	Core Course XII + Practical	3+2	3+1=4
6	Core Course Choice based (Electives) - OptoElectronics	4	3
7	Project work & Field Visit/Study Tour, Visit to research institutes , Group activity	1	1
		25 hrs	20

Total credits 120

SCHEME OF DISTRIBUTION OF INSTRUCTIONAL HOURS

Name of semester	Theory	Practical
First semester	2	2
Second semester	2	2
Third semester	3	2
Fourth semester	3	2
Fifth semester Field Study and Group activity	16 1	8
Sixth semester	16	8
Project work (in 6th semester), Visit to research institutes	1	

1.11. MARKS DISTRIBUTION FOR EXTERNAL EXAMINATION AND INTERNAL EVALUATION

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

Components of the internal evaluation and their marks are as below.

For all courses without practical

a) Marks of external Examination : 75

b) Marks of internal evaluation : 25

All the three components of the internal assessment are mandatory. For common course English in I Semester, internal oral examination shall be conducted instead of test paper.

Components of Internal Evaluation	**MARKS**
Attendance	**5**
Assignment (Written assignments, preparation of models, charts, posters etc., field survey, field work)	**5**
Seminar/Viva	**5**
Test papers-2	**10**
Total	**25**

For all courses with practical

a) Marks of theory –External Examination : 60

b) Marks of theory –Internal Evaluation : 20

Components of Theory – Internal Evaluation	***Marks***
Attendance	***5***
Seminar/ Assignment (Written assignments, preparation of models, charts, posters etc., field survey, field work)	***5***
Test paper(s)	***10***
Total	***20***

c) Marks of Practical –External Examination: 15+15=30 (only in even semesters)

d) Marks of Practical- Internal Evaluation: 5+5=10 (odd and even semesters combined annually)

Components of Practical-Internal evaluation	Marks
Attendance	2
Record	2
Viva/Model Exam	1
Total	**5**

Project Evaluation: (Max. marks100)

Components of Project-Evaluation	Marks
Internal Evaluation	25
Dissertation (External)	50
Viva-Voce (External)	25
Total	**100**

Attendance Evaluation

For all courses with practical – (marks for attendance shall be given considering theory and practical separately, with a minimum eligibility of 75%)

Attendance Evaluation (theory)

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

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

Attendance Evaluation (practical)

Percentage of attendance for Practical	Marks
Above 85 %	2
75-85	1
<75	0

PATTERN OF QUESTIONS

Questions shall be set to assess knowledge acquired, standard application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to

synthesize knowledge. The question setter shall ensure that questions covering all skills are set. He/She shall also submit a detailed scheme of evaluation along with the question paper.

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

Pattern of questions for external examination for theory paper without practical.

	Total no. of questions	Number of questions to be answered	Marks of each question	Total marks
	10	10	1	10
	10	8	2	16
	7	5	5	25
	4	2	12	24
TOTAL	**31**	**25**	x	**75**

Pattern of questions for external examination for theory papers with practical

	Total no. of questions	Number of questions to be answered	Marks of each question	Total marks
	10	10	1	10
	9	7	2	14
	6	4	4	16
	4	2	10	20
TOTAL	**29**	**23**	x	**60**

Note: Board of studies of each subject has the freedom to make changes to this pattern if necessary without changing the total marks. However it is desirable to follow the above pattern.

1.12. CONDONATION OF SHORTAGE OF ATTENDANCE

Candidate can seek condonation of shortage of attendance only once in a 2 year course and twice in other courses of longer duration. Following are the rules regarding attendance requirement:-

1. Every candidate is to secure 75% attendance of the total duration of the course.

2. A candidate having a shortage of 10% can apply for condonation of shortage in prescribed form on genuine grounds. Condonation of shortage of attendance if any should be obtained at least 7 days before the commencement of the concerned semester examination.

3. It shall be the discretion of the Principal to consider such applications and condone the shortage on the merit of each case in consultation with the concerned course teacher and HoD.

4. Unless the shortage of attendance is condoned, a candidate is not eligible to appear for the examination.

2

Grievance Redressal Mechanism

In order to address the grievance of students regarding Continuous internal assessment (CIA) a three-level Grievance Redressal mechanism is envisaged. A student can approach the upper level only if grievance is not addressed at the lower level.

Level 1:

At the level of the concerned course teacher

Level 2:

At the level of a department committee consisting of the Head of the Department,a coordinator of internal assessment for each programme nominated by the HoD and the course teacher concerned.

Level 3:

A committee with the Principal as Chairman, Dean of concerned Faculty, HOD of concerned department and one member of the Academic council nominated by the principal every year as members.

Syllabi

Syllabi for Core Physics Courses

MODEL -------- I

BSc. Programme in Physics

SEMESTER- 1

Course Code	15U1CRPHY01
Title of the course	Methodology in Physics
Semester in which the course is to be taught	1
No. of credits	3 (Theory 2+ Practical 1)
No. of contact hours	36

4.1. COURSE AIM/RATIONALE.

This course will be an introduction to the pursuit of Physics, its history and methodology. The course also aims at emphasizing the importance of measurement which is central to physics.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module II

Historical perspective on Physics and its method (12 Hrs)

Ancient perspectives on the universe - Geocentric model of Ptolemy – Copernican revolution. Galileo, and his emphasis on experiments and observations. Kepler's laws. Newton and the deterministic universe - Maxwell and the unification of electricity, magnetism and optics.
Planck's hypothesis of quantum. Quantum mechanics. Einstein and his theories of relativity. Contributions by S. N. Bose, M. N. Saha, C. V. Raman and S. Chandrasekhar.
Emergence of modern physics and technology - Semiconductor revolution - nanotechnology. Contemporary worldview - the expanding universe – fundamental

particles and the unification of all forces of nature. (All from a historical perspective – details and derivations not required)
Physics, and its relation to other branches of Science. Hypotheses; theories and laws in science- verification (proving), corroboration and falsification (disproving), Revision of scientific theories and laws. Significance of Peer Review. Publications and patents.

Module II
Measuring instruments (12 Hours)

Measurement of time – water clocks – sun dials – pendulum clocks – digital clocks – atomic clocks.
Length measurement – rulers – standard metre – micrometers – screw Gauges travelling microscope – laser range finder- sonar – GPS.
Angle measurement – spectrometer verniers - scale and telescope - measurement of
stellar parallaxes .
Electrical measurement - Working principle of galvanometer, voltmeter, ammeter and digital multimeters.

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

Module III
Error Analysis (12 Hours)

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

Books for references

Reference
1. Gieryn, T.F. Cultural Boundaries of Science., Univ. Chicago Press, 1999.
2. Collins H. and T. Pinch. The Golem: What Everyone Should Know About Science.,Cambridge Univ Press, 1993.
3. Hewitt, Paul G, Suzanne Lyons, John A. Suchocki & Jennifer Yeh, Conceptual Integrated Science, Addison-Wesley, 2007

4. Newton RG. The Truth of Science : New Delhi, 2nd edition
5. Bass, Joel, E and et.al. Methods for Teaching Science as Inquiry, Allyn & Bacon,2009
6. http://www.howstuffworks.com/
7. John R. Taylor. An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, Univ. Science Books
8. http://www.upscale.utoronto.ca/PVB/Harrison/ErrorAnalysis/
9. http://phys.columbia.edu/~tutorial/index.html
10. Scientific Endeavour J A lee Longman

Syllabi for Core Courses

MODEL -------- I

BSc. Programme in -PHYSICS

SEMESTER- 2

Course Code	15U2CRPHY02
Title of the course	Mechanics and Properties of Matter
Semester in which the course is to be taught	2
No. of credits	3 (Theory 2+ Practical 1)
No. of contact hours	36

4.1. COURSE AIM/RATIONALE.

This course would empower the student to acquire engineering skills and practical knowledge, which help the student in their everyday life. This syllabus will cater the basic requirements for their higher studies. This course will provide a theoretical basis for doing experiments in related areas.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (11 Hrs)

Motion under gravity : 5 hrs

Velocity- acceleration- force – acceleration due to gravity-weightlessness, compound pendulum (symmetric and unsymmetric) radius of gyration- kater's pendulum- centripetal acceleration and force- centrifugal force

Rotational mechanics : 6 hrs

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

Module II (9 Hrs)

Oscillation and waves: 9 hrs

SHM, equation of motion to SHM- theory of damped oscillation (over, under, critical)- theory of forced oscillation- resonance- solution and equation to progressive wave- energy of progressive wave- superposition of waves-theory of beats- Doppler effect.

Module III (16 Hrs)

Elasticity: 8 hrs
Stress- strain- Hooke's law- elastic module- Poisson's ratio- bending of Beams bending moment- Young's modulus (cantilever-mirror and telescope)- Young's modulus (uniform and non uniform bending-microscope) torsional oscillations rigidity modulus- static torsion(mirror and telescope)- I section girder.

Surface tension: 4 hrs
Molecular theory of surface tension- surface energy- excess pressure in a liquid Drop transverse waves on the surface of a liquid- effect of gravity- effect of surface tension- factors affecting surface tension- applications.

Viscosity: 4 hrs
Streamline and turbulent flow- critical velocity- derivation of Poiseuille's Formula derivation of - Stoke's formula-Lubricants

Books for references

1. Fundamentals of Physics - Halliday and Resnik (John Wiley)
2. Principles of Mechanics - John. L. Synge and Byron A Griffith (Mc- Graw Hill)
3. Advanced Physics - Materials and Mechanics - Tom Duncan (John Murray London)
4. Mechanics - D.S.Mathur (S.Chand)
5. Classical Mechanics - Goldstein
6. Classical Mechanics - K. SankaraRao (Prentice. Hall of India- N.Delhi)
7. Text Book of Sound - Brijlal and Subramaniam (S.Chand)
8. Refresher Course in Physics - Vol1- C.L.Arora
9. Vibration, Waves and Acoustics - D.Chattopadhyay (Books and Allied Pvt Ltd)
10. Properties of Matter - Brijlal and Subramaniam (S.Chand)
11. Properties of Matter - -D.S.Mathur (S.Chand)
12. Mechanics- H.S.Hans and S.P.Puri. (Tata McGraw-Hill)
13. Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)
14. Mechanics- J.C. Upadhyaya (Ram Prasad and Sons)

Syllabi for Core Courses

MODEL -------- I

BSc.Programme in -PHYSICS

SEMESTER- 3

Course Code	15U3CRPHY03
Title of the course	Electronics
Semester in which the course is to be taught	3
No. of credits	4 (Theory 3+ Practical 1)
No. of contact hours	54

4.1. COURSE AIM/RATIONALE.

We are living in a wonder world of Electronics. To know the physical principles and applications of Electronics is most necessary for a Physics student. This course is intended to provide this know-how.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module-I (15 Hrs)

Basic concepts of semiconductors(15 Hours)
P-N junction Diode-Diode Characteristics-Expression for Diode current (Expression without derivation)-Static and Dynamic resistances-Junction capacitance-Equivalent circuit-Avalanche and Zener breakdown-PIV.
Rectifiers-Half wave-Centre tapped full wave and Bridge rectifiers-Derivation of efficiency and ripple factor of half wave and full wave rectifiers
Filter circuits- Shunt capacitor filter-Series inductor filter-LC filter- π section filter-Voltage regulation-Line regulation and load regulation- Zener diode shunt regulator-Design of circuit-Optimum value of current limiting resistor.
Wave shaping circuits-Clipper-Positive, negative and biased clipping circuits-Clampers-Biased clampers-Voltage multipliers- Doubler-Tripler & Quadrupler.

Module-II (18 Hours)

Transistors (18 Hours)
Transistors-Bipolar junction transistors-Mechanism of amplification in a transistor-

Common base, common emitter and common collector configurations and their characteristics-Active, saturation and Cut-off regions-Current gain α , β , γ and their relationships-Experiment to draw the characteristics of transistor in the CB and CE modes-Leakage currents-Expressions for output currents in the three modes-Thermal runaway-Load line, Q-Point- Classification of amplifiers-Class A,B,AB and C amplifiers Need for biasing-Stabilization-Transistor biasing-Fixed bias-Collector to base bias-Self bias(emitter bias)-Voltage divider bias-Transistor as a switch. AC equivalent circuit using h-parameters-Analysis of a transistor amplifier using h-parameters- Performance of CE,CC and CC amplifiers Basic ideas of FET & MOSFET.

Module-III (21 Hours)

Amplifiers (21 Hours)

Feedback amplifiers-Principle of feedback amplifiers-Positive and negative feedback and its effects - Different types of feedback (Block diagrams only)-Emitter follower. Sinusoidal oscillators-Principle of oscillators-Barkhausen criterion-Tuned collector oscillator-Hartley and Colpitt's Oscillators – RC Phase shift oscillators – Crystal oscillator. Operational amplifiers - Ideal Op-amp - Virtual ground and summing point- Applications-Inverting amplifier - Non inverting amplifier-Unity follower – Summing amplifier (adder).

Modulation and Demodulation -Types of modulation - Amplitude modulation-Percentage modulation-modulation index - Analysis of AM wave – Sidebands – bandwidth - Power in an AM wave-Modulating amplifier circuit.

Frequency modulation-Carrier swing-Modulation index-Deviation ratio-Percentage modulation (Basics only) Demodulation or detection-Diode detector circuit for AM signals.

Books for references

1. Electronic Principles-Sahdev (Dhanpat Rai Co.)
2. Electronic Devices and Circuit Theory-Robert L Boylestad&Louis Nashelsky, PHI
3. Electronic Principles and Applications-Schuler(McGrawHill)
4. Foundations of Electronics-D Chattopadhyay,P.C.Rakshit,B Saha,N.N.Purkait(New Age International Publishers)
5. Principles of Electronics-V.K.Mehta(S.Chand Co.)
6. Electronic Principles-A.P.Malvino 5 th Edition(Tata McGrawHill)
7. Electronic Devices and Circuits-Sajeev Gupta(Dhanpat Rai Publications)
8. Basic Electronics and Linear Circuits-N.N.Bhargava,D.C.Kulshreshtha&S.C.Gupta (Tata McGrawHill)
9. Introduction to Semiconductor Devices, Kevin, Brennan Cambridge Univ. Press
10. Art of Electronics, Thomas C Hayes, Paul Horowitz, Cambridge Univ. Press

Syllabi for Core Courses

MODEL -------- I

BSc.Programme in -PHYSICS

SEMESTER-4

Course Code	15U4CRPHY04
Title of the course	Electricity and Electrodynamics
Semester in which the course is to be taught	4
No. of credits	4 (Theory 3+ Practical 1)
No. of contact hours	54

4.1. COURSE AIM/RATIONALE.

Electricity and Electrodynamics have the key role in the development of modern technological world. Without electric power and communication facilities, life on earth stands still. A course in electricity and electrodynamics is thus an essential component of physics programme at graduate level. This course is expected to provide a sound foundation in electricity and electrodynamics.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (19 Hrs)

Varying Currents: (9 hrs)

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)- Theory of BG-measurement of K of BG using standard capacitance.

Alternating currents & Circuit theory (10 hrs)

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

Module II (25 Hrs)

Electrostatics- (13 hrs)

Electric field- 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, Conductors - Basic properties-induced charges, Surface charge and force on a conductor-Capacitors.

Magnetostatics and Maxwell's equations (12 hrs)

Magnetic field of Steady currents - Comparison of magnetostatics and electrostatics – Maxwell's equations and its derivation from basic laws- Maxwell's equations inside matter – Boundary conditions – Scalar and vector potentials –Poynting vector - Poynting theorem.

Module III (10 Hrs)

Electromagnetic waves (10 hrs)

Production and Detection of EM Waves- Hertz Experiment- The wave equation in one dimension – Plane waves - Polarisation – Boundary conditions- Reflection and transmission - Monochromatic plane waves in vacuum - Energy and momentum of electromagnetic waves – Propagation through linear media –- Modified wave equation in conductors - Monochromatic plane waves in conducting media.

Books for references

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

Syllabi for Core Courses

MODEL -------- I

BSc.Programme in -PHYSICS

SEMESTER- 5

Course Code	15U5CRPHY05
Title of the course	Classical and Quantum Mechanics
Semester in which the course is to be taught	5
No. of credits	4 (Theory 3+ Practical 1)
No. of contact hours	54

4.1. COURSE AIM/RATIONALE.

This course is a prelude to advanced theoretical studies in Condensed Matter Physics, Spectroscopy, Astrophysics, Electrodynamics and Nuclear Physics. Prerequisites: Student should have essential knowledge of Algebra, Calculus and Newtonian Mechanics.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module – I (18 hours)

Lagrange and Hamilton Equations (18 hours)
Constraints and degrees of freedom - Generalized coordinates – Classification of a dynamical system – Principle of virtual work – D'Alemberts Principle - Lagrange's equations for general systems - Applications – one dimensional harmonic oscillator – planetary motion – Hamilton's equations of motion – Application - One dimensional harmonic oscillator - Hamilton's Principle for a conservative system – Principle of least action – Calculus of variations – Lagrange's equation from Hamilton's Principle

Module – II (17 hours)

Quantum Mechanics
I. Emergence of quantum concepts (9 hours)
Black body radiation - Planck's law - Particle nature of radiation – Photoelectric effect - Compton effect - wave nature of matter – deBroglie hypothesis – Davisson and Germer experiment - Uncertainty principle –

probabilistic interpretation of wave function.

II. Time dependent Schrodinger Equation (8 hours)

The Schrodinger equation – Operators - The commutator – Physical Interpretation of wave function – Normalisation probability current density - expectation value – General eigen value equation – eigen value for momentum operator.

Module – III (19 hours)

I. Propagation of wave packet (4 hours)

General solution of one dimensional Schrodinger equation for a free particle – group velocity and phase velocity.

II. Time independent Schrodinger Equation (15 hours)

Stationary state - Time independent Schrodinger equation – boundary and continuity condition for wave functions – degeneracy – orthogonality of wave function – particle in a box (one dimensional) – One dimensional harmonic oscillator – energy eigen value and zero point energy – Orbital angular momentum – commutation relations – Eigen values of L^2 , L_z - Energy eigen values of rigid rotator

Books for references

1. Classical Mechanics - 3 rd Edition: Herbert Goldstein, Charles Poole & John Safk, Pub. 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. Quantum Physics – Stephen Gasirowicz Pub. Pearson Education (IndianEdn.)
7. Quantum Mechanics - Greiner, 4 th Edition, Springer International Edn.
8. Quantum Mechanics G. Aruldhas, Premtice Hall of India.
9. Concepts of Modern Physics - Arthur Beiser, Tata Mc Graw Hill.
10. Applied Quantum Mechanics, A F J Levi, Cambridge Univ. Press

Syllabi for Core Courses

MODEL -------- I

BSc. Programme in -PHYSICS

SEMESTER- 5

Course Code	15U5CRPHY06
Title of the course	Physical Optics and Photonics
Semester in which the course is to be taught	5
No. of credits	4 (Theory 3+ Practical 1)
No. of contact hours	54

4.1. COURSE AIM/RATIONALE.

This course aims to provide necessary foundation in optics and photonics which prepare the students for an intensive study of advanced topics at a later stage.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (22 Hrs)

Interference (11 hrs)

Review of basic ideas of interference, (Coherent waves-Optical path and phase change-superposition of waves, condition for bright and dark fringes).Thin films - plane parallel film-interference due to reflected light-conditions for brightness and darkness-interference due to transmitted light-Haidinger fringes-interference in wedge shaped film-colours in thin films-Newton's rings. Michelson interferometer construction and working - applications (qualitative ideas only).

Diffraction (11 hrs)

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.

Module II (10 Hrs)

Polarization (10hrs)

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- Production and Detection ofelliptically and circularly polarized light Retarders orwave plate- Quarter wave plate – Half wave plate- - Optical Activity-Fresnels Explanation of Optical Rotation-(Analytical treatment not needed) – Specific Rotation-Laurents half shade polarimeter.

Module-III (22 Hrs)

Lasers (12hrs)

Absorption and emission of light-Absorption-spontaneous emission and stimulated emission-light amplification by stimulated emission. Einstein's relations-condition for light amplification –population inversion-pumping –pumping methods –optical pumping – electrical pumping -direct conversion. Active medium-metastable statespumping schemes (two level, three level and four level) Optical resonator (theory not required) Threshold condition. Types of lasers-ruby laser, He-Ne laser, semiconductor laser. Applications of lasers-Holography (principle, recording and reconstruction)

Fibre Optics and Optical Communication (10hrs)

Optical fibre- Critical angle of propagation-modes of propagation- Acceptance angle-Fractional refractive index change- Numerical Aperture- Types of Optical fibers-Normalized Frequency- pulse dispersion Attenuation- Applications- Fibre optic communication system- Advantages of Optical fibers.

Books for references

1. Optics 3 rd 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.

Syllabi for Core Courses

MODEL -------- I

BSc.Programme in -PHYSICS

SEMESTER - 5

Course Code	15U5CRPHY07
Title of the course	Thermal and Statistical Physics
Semester in which the course is to be taught	5
No. of credits	4 (Theory 3+ Practical 1)
No. of contact hours	54

4.1. COURSE AIM/RATIONALE.

This course is to develop a working knowledge of statistical mechanic and to use this knowledge to explore various applications related to topics in material science and the physics of condensed matter.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (18 hrs)

Thermal Physics (18 hrs)
Laws of Thermodynamics: Zeroth law. First law- internal energy, Applications of first law, Indicator diagram, Work done during isothermal and adiabatic process, slopes, relation between them , cooling due to Adiabatic reversible processes . Reversible and irreversible processes, Second law, Heat Engines, Carnot cycle and theorem, Work done by the engine per cycle, efficiency, Otto Engine, Petrol engine, Diesel Engine, Third law of thermodynamics -Unattainability of absolute zero

Module II (18 hrs)
Thermodynamic relations and Heat Transmission (18 hrs)
Entropy, entropy changes in reversible and irreversible processes, Entropy – temperature diagrams and equations. Physical significance of entropy. Clausius Clepeyron Equation. Thermodynamic potentials: Enthalpy, Gibbs and Helmholtz functions, Maxwell's relations and applications, Concepts of adiabatic and isothermal elasticity

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).

Module III (18 hrs)

Statistical Mechanics (18hrs)
Micro and Macro states, thermodynamic probability, energy states, energy levels, degenerate energy levels, degenerate gas, phase space, concept of entropy and thermodynamic probability.
Classical Statistics: Maxwell-Boltzmann Distribution law, thermodynamics of an ideal monoatomic gas, Classical entropy expression, Gibbs' paradox.
Quantum Statistics:
Need of quantum statistics- In-distinguishability 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

Books for references

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

Syllabi for Core Courses

MODEL -------- I

B.Sc. Programme in -PHYSICS

SEMESTER-5

Course Code	15U5CRPHY08
Title of the course	Digital Electronics
Semester in which the course is to be taught	5
No. of credits	4 (Theory 3+ Practical 1)
No. of contact hours	54

4.1. COURSE AIM/RATIONALE.

This course is expected to provide necessary back ground for applications of electronics in mathematical computation.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (8 hrs)

Number systems (8 hrs)

Digital and analog systems- Comparison, Different number systems- decimal, binary, octal and hexadecimal-conversion between different systems- Binary arithmeticaddition, subtraction and multiplication. Subtraction with 2's complement and 1's complement- BCD code, ASCII code

Module II (20 hrs)

Boolean algebra (20 hrs)

Binary logic- AND,OR and NOT operators- Logic symbol and truth table-Laws of Boolean algebra- Demorgan's theorem- Duality theorem- Boolean functions- Complement of a function- Reducing Boolean expressions- Canonical and standard form- Conversion between truth table, Boolean expressions and Logic diagrams- Simplification of Boolean functions using Karnauh map(Two, three and four variables) NAND, NOR, XOR, XNOR gates- IC digital logic families (Familiarization only)

Module III (26 hrs)

Combinational Logic (9 hrs)
Adders- Half and Full adders- Subtractor- Four bit adder- Subtractor. Encoders, Decoders, Multiplexers and Demultiplexers
Sequential logic (17 hrs)
Flip-flops, RS, Clocked RS, MSJK FF, DFF JK, T Flip-flop, Buffer registers- Shift register- Counters- Binary ripple counter- BCD ripple counter- synchronous binary counter- Decade counter. D/A converters (Ladder type), A/D Converter (Counter type).

Books for references

1. Digital design- M Morris Mano PHI
2. Digital logic and computer design - M Morris Mano PHI
3. Digital Electronics- William H Gothmann PHI
4. Digital principles and applications 6 th Edn. Malvino, Leach and Saha TMH
5. Digital circuits and design- S Salivahanan and S Arivazhakan PHI
6. Digital Electronics- Sedha S Chand
7. Pulse, Digital and switching wave forms –Millam and Taub.
8. Digital computer electronics- Malvino, Brown TMH
9. Digital electronics- Tokheim(TMH)

Syllabi for Complementary Courses (OPEN COURSE)

MODEL -------- I

B.Sc. Programme in -PHYSICS

SEMESTER - 5

Course Code	15U5OCPHY1
Title of the course	Energy and Environmental Studies
Semester in which the course is to be taught	5
No. of credits	3 (Theory 3)
No. of contact hours	72

4.1. COURSE AIM/RATIONALE.

The course creates concern among the students on energy conservation and environmental protection.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (30 Hrs)

Energy sources (14 hrs)

World's reserve of energy sources - various forms of energy - non- renewable energy sources:- coal, oil, natural gas; merits and demerits - renewable energy sources:- solar energy, biomass energy, biogas energy, wind energy, wave energy, tidal energy, hydro energy, geothermal, fusion energy, hydrogen; merits and demerits - storage of intermittently generated renewable energy (qualitative).

Solar energy utilization (16 hrs)

Sun as a source of energy - solar radiation - spectral distribution - flat plate collector- solar water heating – different types of solar water heaters - solar pond - convective and salt gradient types - optical concentrator - solar desalination - solar dryer – direct and indirect type - solar cooker - direct and indirect type - solar heating of buildings - solar green houses- solar photovoltaics - working principle.

Module II (20 Hrs)

Environmental pollution (20 hrs)

Basic concepts of ecology and environment - environmental pollution:- primary and secondary pollutants, classification - environmental degradation (causes, effects and control/treatment methods):- air pollution:- green house

gases, global warming, climatic effects, water pollution, soil pollution, groundwater pollution, marine pollution, noise pollution, nuclear hazards - environmental pollution due to environmental disasters.

Module III (22 Hrs)

Environment impact assessment and control (8 hrs)

Basic ideas of environment impact assessment - environment ethics - environmental laws and constitutional provisions to control pollutions in India:- the general acts , water and air acts , environment protection acts.

Waste management (14 hrs)

Waste minimization and resource conservation:- source reduction, recycling , conservation and waste minimization - management of solid wastes (management and handling):- hazardous solid waste, municipal solid wastes, biomedical solid wastes - waste treatment and disposal methods:- physical, biological and chemical process- biogas plant-moving dome type.

Books for references

1. Essential Environmental Studies S.P Misra, S.N Pandey (Ane Books Pvt Ltd)
2. Environmental Science G Tyler Miller (Cengage Learning)
3. Introduction to Environmental Science Y Anjaneyulu (B S Publications)
4. Introduction to Environmental engineering and science- G.M. Masters and W.P. Ela(PHI Pvt. Ltd)
5. Environmental management- B. Krishnamoorthy (PHI Pvt. Ltd)6. Solar energy- fundamentals and applications- H.P. Garg and J. Prakash (Tata Mc Graw Hill).
7. Solar energy-fundamentals, design, modeling and applications- G.N. Tiwari (Narosa Pub. House).

Syllabi for Core Courses

MODEL -------- I

B.Sc. Programme in -PHYSICS

SEMESTER - 6

Course Code	15U6CRPHY09
Title of the course	Computational Physics
Semester in which the course is to be taught	6
No. of credits	4 (Theory 3+ Practical 1)
No. of contact hours	54

4.1. COURSE AIM/RATIONALE.

This course is intended to give an insight to computer hardware and computer applications.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module 1 (20 hrs)

Microprocessors (20 hrs)

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.

Microprocessors Basics

Microcomputer organization – Microprocessors – evolution of Microprocessors& IC Technology

-- general organization – application of Microprocessors – computer languages – machine

languages – assembly languages – high level languages--– operating system

Memory- size, primary memory(RAM,ROM) - secondary memory –

Number systems--binary number system – decimal, Binary coded decimal – Hexadecimal- ASCII code

8085 architecture

8085 pin out – 8085 internal architecture – bus structure– data bus - address bus – control bus – 8085 based micro computer system – functions of Microprocessors – Microprocessors initiated operations, internal operations, and peripheral initiated operations

Instructions and Timing

Instruction classification – instruction format – addressing modes – instruction set – simple program for data transfer – addition – subtraction

T state – machine cycle – instruction cycle – instruction timing and operation status

Module II (22 hrs)

Computer hardware (5 hrs)

Characteristics of a computer- I/O devices- memory and storage devices- RAM, ROM, Primary and secondary memory

Programming in C ++ (17 hrs)

Introduction- C ++ programming basics- Object oriented programming – Introduction – Basic program construction – Program construction – Program statements – Directives – variable types – Arithmetic operators – Library functions – loops – Decisions – Control statements – Switch – Break – logical operators – functions – overloaded functions – Inline function – default arguments – returning by reference – objects – Structures – Classes – Arrays – Strings – C++ programs using above syllabus

Reference

1. Object Oriented Programming in Turbo C++ - Robert Lafore (Galgotia pub.)

   Chapter 1,2,3,4,5,6,7

Module III (12 hrs)

Numerical methods (12 hrs)

Iteration principle- solution of algebraic and transcendental equations- bisection, false position and Newton-Raphson methods- algorithms-algorithm & C++ program - numerical integration trapezoidal rule and Simpson's 1/3 rule - algorithm- algorithm & C++ program Numerical solution of differential equation- Euler's method and second order Runge-Kutta method algorithm.algorithm & C++ program Computer oriented numerical methods using C ++

Books for references

1. Microprocessor architecture, programming and applications- Ramesh S. Gaonkar (Penram Int. Pub.)
2. Fundamentals of Microprocessors and microcomputers- B. Ram (Dhanpat Rai Pub.)
3. Microcomputers and Microprocessors- John Uffenbeck (PHI Pub.)
4. Object oriented programming in Turbo C ++ - Robert Lafore (Galgotia Pub.)
5. Programming with C ++ - John R. Hubbard (Mc Graw Hill Pub.)
6. Numerical method- V. Rajaram (PHI Pub.)
7. Introductory methods of Numerical methods -S.S .Sastry (PHI Pub.)
8. Numerical method with computer programming in C ++ - Ghosh (PHI Pub.)

Syllabi for Core Courses

MODEL -------- I

B.Sc. Programme in -PHYSICS

SEMESTER - 6

Course Code	15U6CRPHY10
Title of the course	Nuclear and Particle Physics
Semester in which the course is to be taught	6
No. of credits	4 (Theory 3+ Practical 1)
No. of contact hours	54

4.1. COURSE AIM/RATIONALE.

This course intended to explore the interior of nucleus and interaction between nucleons

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (15 Hrs)

Nuclear structure & General properties of nuclei (15 hr)

Classification of nuclei – Isotopes, Isobars, Isomers, Mirror nuclei. General properties of nucleus – size, nuclear mass, density, charge, angular momentum, nuclear magnetic dipole moments, electric quadrupole moment, Mass defect, B.E, B.E. curve, packing fraction, nuclear stability. Theories of nuclear composition – proton-electron hypothesis – proton-neutron hypothesis. Properties of Nuclear forces – Meson theory of nuclear forces. Nuclear shell model. Determination of nuclear mass by Bainbridge's mass spectrograph. Detectors of nuclear radiations – ionisation chamber - G.M Counter.

Module II (18 Hrs)

Radioactivity (18 hr)

Natural radioactivity – Radioactive disintegration law – half life – Mean life Radioactive series. Radioactive dating – Uranium dating & Carbon dating Range of α particles – range – energy relationship. Geiger – Nuttal law Alpha particle disintegration energy Theory of α - delay – Gamow's theory β- decay - β ray energy spectrum Neutrino hypothesis Positron emission, orbital electron capture (Basic ideas only) γ decay – Internal conversion Electron positron pair production by γ

rays. Electron positron annihilation. Artificial radioactivity & Transuranic elements. (Basic ideas only)

Module III (22 Hrs)

Nuclear fission & Fusion (11 hr)

Discovery of nuclear fission – Fission products. Neutron emission in fission. Energy release in fission. Nuclear fission on the basis of liquid drop model chain reaction – Nuclear reactor – Breeder reactor Nuclear fusion Energy production in stars – Proton-Proton cycle and Carbon - Nitrogen cycle Peaceful utilization fusion power Controlled thermo nuclear reactions Toroidal confinement – Tokamak Nuclear waste disposal and radiation hazards from nuclear explosion – radiation dosage.

Elementary particles (10 hr)

Particles and antiparticles – Fundamental interactions in nature. Classification of elementary particles according to nuclear interactions. Resonance particles Elementary particle quantum numbers and conservation laws. The quark model – compositions of hadron according to quark model. Cosmic rays – Primary and secondary- lattitude effect- altitude effect- eastwest effect

Books for references

1. Nuclear Physics Principles and Applications. Lilley, Pub. John. Wiley
2. Nuclear and Particle Physics S L Kakani and Subhra Kakani -Viva Books 2008

Syllabi for Core Courses

MODEL -------- I

B.Sc. Programme in -PHYSICS

SEMESTER - 6

Course Code	15U6CRPHY11
Title of the course	Condensed Matter Physics
Semester in which the course is to be taught	6
No. of credits	4 (Theory 3+ Practical 1)
No. of contact hours	54

4.1. COURSE AIM/RATIONALE.

This course is intended to provide an introduction to the physics of Condensed Matter. This study attempts to explain various types of phenomena like electro-magnetic properties, super-conductivity and super fluidity.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (27 Hrs)

Crystal structure and Bonding (12 hrs)

Crystal Structure - Crystalline Matter - Bravias Lattice - Crystal Systems - Crystal Planes - and Miller Indices - Lattice Constants - Reciprocal Lattice - Crystal Structures - sc, bcc, fcc and hcp - Bragg's Law - Experimental Methods of X-Ray diffraction - Powder method. Bonding in Solids - Ionic, Covalent, Van der Waal and Metallic Bonding (qualitative) - Binding Energy in Crystals - Madelung Constant.

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

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.

Module II (10 Hrs)

Dielectric and Magnetic Properties of Solids (10Hrs)

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.

Module III (17 Hrs)

Superconductivity (10 hrs)

History of superconductivity- Super conducting phenomena- Meissner effect- Penetration depth, critical field and critical temperature- Type I& II Superconductors- Josephson Effect – SQUID, Theorems of Super conductivity- London equation-BCS theory-High Tc superconductors and applications.

Materials Science and Technology (7hrs)

Amorphous Semiconductors - Liquid Crystals – Polymers - Thin films - Properties- Crystalline Materials and Applications - Nanostructures and Nanometerials- Applications.

Books for 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

Syllabi for Core Courses

MODEL -------- I

B.Sc. Programme in -PHYSICS

SEMESTER - 6

Course Code	15U6CRPHY12
Title of the course	Relativity and Spectroscopy
Semester in which the course is to be taught	6
No. of credits	4 (Theory 3+ Practical 1)
No. of contact hours	54

4.1. COURSE AIM/RATIONALE.

This course is intended to introduce principles of spectroscopy and special theory of relativity.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (18 Hrs)

Special Theory of Relativity.(18 hours)

Inertial and non inertial frames of reference – Galilean transformation – Significance of Michelson – Morley experiment – postulates of STR- Lorentz transformation – spatial contraction - time dilation – composition of velocities – Mass of a moving particle – Equivalence of mass and energy – Introductory concepts of general theory of relativity

Module II (18 hours)

Atomic spectroscopy (18 hours)

Historical introduction. Electromagnetic spectrum. Types of spectra. Absorption and emission of light by atoms- quantum theory- early atom models -Bohr model- – electron spin and magnetic moment - Exclusion principle - Stern- Gerlach experiment - Vector atom model - quantum numbers associated with vector atom models- Total angular momentum and LS coupling– fine structure of Sodium D-lines. Zeeman effect- quantum mechanical explanation for anomalous Zeeman effect – Paschen– Back effect. NMR and ESR spectroscopy (qualitative ideas only)

Module III (18 hours)

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. IR and Microwave spectroscopes.

Books for references

1. Arthur Beiser; Concepts of modern Physics.
2. C. Banwell and E. Mccash; Fundamentals of Molecular Spectroscopy.
3. G. Aruldhas; Molecular structure and Spectroscopy.
4. Classical Mechanics – K. Sankara Rao, Prentice Hall of India

Syllabi for CoreCourses

MODEL -------- I

B.Sc. Programme in -PHYSICS

SEMESTER - 6

Course Code	15U6CRPHY13
Title of the course	Optoelectronics
Semester in which the course is to be taught	6
No. of credits	4
No. of contact hours	90

4.1. COURSE AIM/RATIONALE.

This century is going to be the century of Optoelectronics or Photonics – the light wave technology. Today we have optical technologies replacing electronic memories, amplifiers etc. These enable high speed computing. Hence no Physics student can avoid this latest field of science and technology.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (28 Hrs)

Optoelectronic Fundamentals

Introduction to Photonics (12 hrs)

(i) Optical radiation and light- Luminescence and Radiation--Photometric and Radiometric terms and units-Inverse square law – verification by photometer comparison of efficiency of light sources available in the market and recommended values of illumination for various activities (General awareness).

(ii) Introduction to Photonics – electrons Vs photons – Electronics Vs Optics Photonics - Photonics and light technology and applications.

(iii) Properties of Photons - (iv) Gausian beams – beam characteristics and parameters(Qualitative ideas only).

Optical process in semiconductors (16 hrs)

Direct and indirect bandgap semiconductors - Electron hole pair formation and recombination. Radiative and nonradiative recombination and recombination rates. Absorption in semiconductors – indirect transitions, exciton absorption, donor- acceptor band impurity band

absorption. Long wavelength absorption. Franz Keldysh and Stark effect. Radiation in semiconductors. Stokesshift in optical transitions. Frank – Condon shift, Auger recombination.

Module II (30 Hrs)

Optical Devices

Radiation sources (12hrs)

(i) LED –Principle –characteristics (V-I & light – current)–materialsefficiencies- LED structures- hetero junction and edge emitting LED-. Applications &advantages.

(ii) Semiconductor lasers – Homo junction and hetero junction and Quantum well lasers- wave guiding and index guiding -Optical and carrier confinement.

Photodetectors (12hrs)

Introduction- Classification of detectors- Qualitative idea of each type- Photo detector parameters – Noise mechanisms – Principle and operation of Photodiode, APD, Phototransistor, PIN photodiode- opto isolators

Solar cells (6 hrs)

Principle-. V-I characteristics- Fill factor –Maximum power and conversion efficiency

Hetero junction solar cells (Qualitative study)-

Module III (32 Hrs)

Optical Communication

(i) Introduction (5hrs)

Introduction to Optical communication- Historical perspective- Advantages and disadvantages of optical communication links in comparison with radio and microwave system and with guided systems- measurement of information and thecapacity of telecommunication channel- Communication system architecture- basic optical communication system – Definition of attenuation, pulse duration and band width.

(ii) Optical Modulation. (15hrs)

Direct modulation of LED and diode laser. Digital and analog modulation of LED and diode laser. External modulation. Birefringence, Pockel effect , phase modulation. Wave guide modulators . Electro-optic , Magneto- optic and acousto-optic modulators. Bipolar controller modulator.

(iii) Fibre optic communication (12hrs)

Introduction to Optical fibres and fibre optic communication- Types of optical fibres- Numerical aperture- Fibre bundles, cables- strength-fibre optical properties- Fibre materials – Classification of fibres – Step index and graded index- mono mode and multi mode fibres –plastic fibreslatest developed fibres- Fibre loses.

Books for references

1. Optoelectronic Engineering S.N. Biswass, Dhanpat Rai Publications
2. A Text book of Optics- Brijlal, Subramoniam, S Chand & Co
3. Photonics Elements and Devices, V. V. Rampal , Wheeler Publishing Co

4. Photonics, Ralf Menzel, Springer
5. Semiconductor optoelectronic devices – Pallab Bhattacharya PHI
6. Optoelectronics Wilson and Hawkes
7. Optoelectronics Jasprit Singh
8. Semiconductor Physics and Devices – Donald A Neamen, Tata McGraw-Hill
9. Optical communication system- John Gowar , Prentice Hall of India
10. Optical Electronics – Ajoy Ghatak and K Thyagarajan Cambridge
11. Optical fibres and fibre optic communication systems, Subir Kumar Sarkar, S.Chand & Co
12. Semiconductor Physics and Optoelectronis, V. Rajendran et al, Vikas Publishing House
13. Fibre Optic Communication, D.C.Agarwal, Wheeler Publishing
14. Physics of Semiconductor devices, Dilip K Roy, University Press.

15. Physics of Semiconductor devices, S M Sze, Wiley Eastern Limited

Syllabi for Complementary Physics for B.Sc. Mathematics

MODEL -------- I

B.Sc. Programme in -Mathematics

SEMESTER – 1

Course Code	15U1CPPHY01
Title of the course	Properties of Matter, Mechanics and Fourier analysis
Semester in which the course is to be taught	1
No. of credits	3 (Theory 2+ Practical 1)
No. of contact hours	36

4.1. COURSE AIM/RATIONALE.

The syllabus will cater into the basic requirements for his/her higher studies.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (12 hrs)
Elasticity (12 hrs)
Elastic moduli- Poisson's ratio- twisting couple- determination of rigidity modulus- static and dynamic methods- static torsion- torsion pendulum bending of beams- cantilever-uniform and non-uniform bending

Module II (10 hrs)
Rotational dynamics of rigid bodies (10 hrs)
Angular velocity- angular momentum- torque- conservation of angular momentum- angular acceleration- moment of inertia- parallel and perpendicular axes theorems- moment of inertia of rod, ring, disc, cylinder and sphere- flywheel

Module III (14 hrs)
Oscillations (9 hrs)
Periodic and oscillatory motion- simple harmonic motion- differential equation- expression for displacement, velocity and acceleration- graphical representation- energy of a particle executing simple harmonic motion damped

oscillation- forced oscillation and resonance
Fourier analysis (5 hrs)
Fourier's theorem- evaluation of Fourier coefficients- analysis of square wave, saw tooth wave and triangular wave

Books for references

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

Syllabi for Complementary Physics for B.Sc. Mathematics

MODEL -------- I

B.Sc. Programme in -Mathematics

SEMESTER – 2

Course Code	15U2CPPHY03
Title of the course	Electric and Magnetic phenomena, Thermodynamics and Special theory of Relativity
Semester in which the course is to be taught	2
No. of credits	3 (Theory 2+ Practical 1)
No. of contact hours	36

4.1. COURSE AIM/RATIONALE.

The syllabus will cater into the basic requirements for his/her higher studies.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (14 Hrs)
Dielectric materials (7 hrs)
Dielectrics- polar and non-polar dielectrics- polarization- sources of polarization- Gauss's law in dielectrics- permittivity- dielectric displacement vector- dielectric constant-susceptibility- ferroelectricity
Magnetic Materials (7 hrs)
Magnetization in materials- linear and non-linear materials- Diamagnetism paramagnetism- ferromagnetism- hysteresis- ferromagnetic Domains antiferromagnetism- ferrimagnetism

Module II (12 Hrs)
Thermodynamics (12 hrs)
Thermodynamic systems- thermodynamic equilibrium- thermodynamic processes- isothermal process- adiabatic process- zeroth law of thermodynamics first law of thermodynamics- heat engine- the Carnot engine- refrigerator concept of entropy- second law of thermodynamics- third law of thermodynamics- Maxwell's thermodynamic relations.

Module III (10 Hrs)

Special theory of relativity (10 hrs)

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

Books for references

1. Introduction to Modern Physics- H.S. Mani and G.K. Mehta (Affiliated East West press Pvt. Ltd)
2. Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)
3. Modern Physics- R. Murugeshan (S. Chand and Co.)
4. Introduction of Electrodynamics- D.J. Griffiths (PHI Pvt. Ltd)
5. Modern Physics- G.Aruldas and P.Rajagopal (PHI Pub)
6. Thermodynamics- Zemansky and Dittmann (Tata McGraw-Hill)
7. Heat and Thermodynamics- Brijlal and Subrahmanyam (S. Chand &Co)

Syllabi for Complementary Physics for B.Sc. Mathematics

MODEL -------- I

B.Sc. Programme in -Mathematics

SEMESTER – 3

Course Code	15UCPPHY05
Title of the course	Quantum Mechanics, Spectroscopy, Nuclear Physics, Basic Electronics and Digital Electronics
Semester in which the course is to be taught	3
No. of credits	4 (Theory 3+ Practical 1)
No. of contact hours	54

4.1. COURSE AIM/RATIONALE.

The syllabus will cater into the basic requirements for his/her higher studies.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (24 Hrs)

Elementary Quantum theory (12 hrs)

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 wavefunctions- box normalization

Spectroscopy (12 hrs)

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

Module II (10 Hrs)

Atomic nucleus and radioactivity (10 hrs)

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 -radio active series-radio active dating- carbon dating artificial radioactivity

Module III (20 Hrs)

Basic electronics (13 hrs)

Semiconductors- doping- band structure- PN junction- biasing- Diode equation (derivation not expected) - diode characteristics- Zener diode- voltage regulation- diode circuits- rectification- half wave, full wave and bridge rectifiers- transistors- different configurations- characteristics- biasing transistor amplifiers- feedback in amplifiers

Digital electronics (7 hrs)

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

Books for references

1. Introduction to Modern Physics- H.S. Mani and G.K. Mehta (Affiliated East West press Pvt. Ltd)
2. Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)
3. Modern Physics- R. Murugeshan (S. Chand and Co.)
4. 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

Syllabi for Complementary Physics for B.Sc. Mathematics

MODEL -------- I

B.Sc. Programme in -Mathematics

SEMESTER – 4

Course Code	15U2CPPHY07
Title of the course	Physical Optics, Laser Physics and Astrophysics
Semester in which the course is to be taught	4
No. of credits	4 (Theory 3+ Practical 1)
No. of contact hours	54

4.1. COURSE AIM/RATIONALE.

The syllabus will cater into the basic requirements for his/her higher studies.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (20 Hrs)

Interference (12 hrs)

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

Diffraction (8 hrs)

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

Module II (15 Hrs)

Polarization (15 hrs)
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

Module III (19 Hrs)
Laser Physics (10 hrs)
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
Astrophysics (9 hrs)
Spectral classification of stars – Hertzsprung – Russel Diagram – Luminosity of Star – Stellar Evolution – White Dwarfs - Electrons in a White Dwarf Star – Chandrasekhar Limit – Neutron Stars – Black Holes – Supernova Explosion.
(All topics to be treated qualitatively)

Books for references

1. Introduction to Modern Physics- H.S. Mani and G.K. Mehta (Affiliated East West press Pvt. Ltd)
2. Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)
3. Modern Physics- R. Murugeshan (S. Chand and Co.)
4. 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)

Syllabi for Complementary Physics for B.Sc. Chemistry

MODEL -------- I

B.Sc. Programme in -Chemistry

SEMESTER – 1

Course Code	15U1CPPHY02
Title of the course	Properties of Matter, Mechanics and Particle Physics
Semester in which the course is to be taught	1
No. of credits	3 (Theory 2+ Practical 1)
No. of contact hours	36

4.1. COURSE AIM/RATIONALE.

The syllabus will cater into the basic requirements for his/her higher studies.This course will provide a theoretical basis for doing experiments in related areas.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (12 Hrs)
Elasticity (12 hrs)
Elastic moduli- Poisson's ratio- twisting couple- determination of rigidity modulus- static and dynamic methods- static torsion- torsion pendulum bending of beams- cantilever-uniform and non-uniform bending

Module II (10 Hrs)
Rotational dynamics of rigid bodies (10 hrs)
Angular velocity- angular momentum- torque- conservation of angular momentum- angular acceleration- moment of inertia- parallel and perpendicular axes theorems- moment of inertia of rod, ring, disc, cylinder and sphere- flywheel

Module III (14 Hrs)
Oscillations (9 hrs)

Periodic and oscillatory motion- simple harmonic motion- differential
Equation expression for displacement, velocity and acceleration- graphical representation- energy of a particle executing simple harmonic motion damped oscillation- forced oscillation and resonance
Particle Physics (5 hrs)
Fundamental interactions in nature- gauge particles- classification of
Particles antiparticles- elementary particle quantum numbers- conservation laws- quark model (qualitative)

Books for references

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

Syllabi for Complementary Physics for B.Sc. Chemistry

MODEL -------- I

B.Sc. Programme in -Chemistry

SEMESTER – 2

Course Code	15U1CPPHY04
Title of the course	Electric and Magnetic Phenomena, Thermodynamics and Elementary Solid State Physics
Semester in which the course is to be taught	2
No. of credits	3 (Theory 2+ Practical 1)
No. of contact hours	36

4.1. COURSE AIM/RATIONALE.

: This syllabus will cater the basic requirements for their higher studies.
Prerequisites: Basic knowledge of electricity, magnetism, heat, thermodynamics, mathematical tools.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (14 Hrs)
Dielectric materials (7 hrs)
Dielectrics- polar and non-polar dielectrics- polarization- sources of polarization- Gauss's law in dielectrics- permittivity- dielectric displacement vector- dielectric constant-susceptibility- ferro electricity
Magnetic materials (7 hrs)
Magnetization in materials- linear and non-linear materials- Diamagnetism paramagnetism- ferromagnetism- hysteresis- ferromagnetic Domains antiferromagnetism- ferrimagnetism

Module II (10 Hrs)
Crystalline solids (10 hrs)

Crystalline and amorphous solids- crystal lattice- basis- unit cell- lattice parameters- crystal systems- crystal planes and directions- miller indices- simple cubic- fcc -bcc hcp structures- packing fraction- NaCl structure- crystal diffraction- Bragg's law

Module III (12 Hrs)

Thermodynamics (12 hrs)

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

Books for references

1. Thermodynamics- Zemansky and Dittmann (Tata McGraw-Hill)
2. Heat and Thermodynamics- Brijlal and Subrahmanyam (S. Chand &Co)

Syllabi for Complementary Physics for B.Sc. Chemistry

MODEL -------- I

B.Sc. Programme in -Chemistry

SEMESTER – 3

Course Code	15U1CPPHY06
Title of the course	Quantum mechanics, Spectroscopy, Nuclear Physics and Electronics
Semester in which the course is to be taught	3
No. of credits	4 (Theory 3+ Practical 1)
No. of contact hours	54

4.1. COURSE AIM/RATIONALE.

The syllabus will cater into the basic requirements for his/her higher studies.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (24 Hrs)
Elementary Quantum theory (12 hrs)
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 wavefunctions- box normalization
Spectroscopy (12 hrs)
Atom models- Thomson's model-Rutherford's nuclear atom model-Bohr atom model- Somerfeld's relativistic atom model- vector atom model- Fine structure of Hydrogen atom -Rotational and vibrational spectra of rigid diatomic molecules- Raman effect-quantum theory

Module II (17 Hrs)
Atomic nucleus and radioactivity (10 hrs)
Nuclear constituents- different nuclear types- properties of nuclei- size-

masscharge- 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 liferadioactivity units -radio active series-radio active dating- carbon datingartificial radioactivity
Nuclear fission and fusion (7 hrs)
Nuclear fission- energy release in fission reactions- liquid drop model of fissionchain reaction- nuclear reactor- power and breeder reactor- atom bombnuclear fusion- energy production in stars- thermo nuclear reactions in sun- p-p chain - C-N cycle

Module III (13 Hrs)
Basic electronics (13 hrs)
Semiconductors- doping- band structure- PN junction- biasing- Diode equation (derivation not expected) - diode characteristics- Zener diode- voltage regulation- diode circuits- rectification- half wave, full wave and bridge rectifiers- transistors- different configurations- characteristics- biasing transistor amplifiers- feedback in amplifiers

Books for references

1. Introduction to Modern Physics- H.S. Mani and G.K. Mehta (Affiliated East West press Pvt. Ltd)
2. Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)
3. Modern Physics- R. Murugeshan (S. Chand and Co.)
4. 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)

Syllabi for Complementary Physics for B.Sc. Chemistry

MODEL -------- I

B.Sc. Programme in -Chemistry

SEMESTER – 4

Course Code	15U1CPPHY08
Title of the course	Physical Optics, Laser Physics and Superconductivity
Semester in which the course is to be taught	4
No. of credits	4 (Theory 3+ Practical 1)
No. of contact hours	54

4.1. COURSE AIM/RATIONALE.

The syllabus will cater into the basic requirements for his/her higher studies.

4.2. OBJECTIVES OF THE COURSE.

4.3. COURSE DESIGN

Module I (20 Hrs)
Interference (12 hrs)
Interference of light- Principle of superposition- conditions for maximum and minimum intensities- coherent sources- Interference by division of wave front and division of amplitude- Young's double slit experiment (division of wave front) –Expression for fringe width- Newton's rings by reflected light (division of amplitude) - measurement of wavelength of sodium light by Newton's rings interference in thin films
Diffraction (8 hrs)
Introduction – Difference between Interference and diffraction- Fresnel and Fraunhofer diffraction- Fresnel Diffraction at a straight edge- Theory of plane transmission grating- Determination of wavelength (normal incidence) – resolving power- dispersive power

Module II (15 Hrs)
Polarization (15 hrs)
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

Module III (19 Hrs)

Laser Physics (10 hrs)

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

Superconductivity (9 hrs)

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

Books for references

1.Introduction to Modern Physics- H.S. Mani and G.K. Mehta (Affiliated East West press Pvt. Ltd)
2.Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)
3.Modern Physics- R. Murugeshan (S. Chand and Co.)
4.Modern Physics- G.Aruldas and P.Rajagopal (PHI Pub)
5.Solid State Physics- R. K. Puri and V.K. Babbar (S. Chand and Co.)

LimitedSYLLABUS FOR PRACTICAL – CORE COURSES

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

SEMESTER I: 15U1CPPHY01

1. Vernier Calipers - Volume of a cylinder, sphere and a hollow cylinder
2. Screw gauge - Volume of a sphere and a glass plate
3. Spherometer - Thickness of a glass plate, radius of curvature of a convex surface and a concave surface
4. Beam balance - Mass of a solid (sensibility method), radius measurement of capillary tube using mercury
5. Travelling microscope - Radius of a capillary tube
6. Multimeter -Measurement of resistance, potential difference, current
7. Multimeter -Checking of capacitor ,diode ,inductance and transistor
8. Identification of electronic components- Coil, capacitor, resistor, transistor, triac, diac, I C's 741,555 etc.
9. Viscosity of a liquid -Variable pressure head
10. Spectrometer - Angle of prism

SEMESTER II: 15U1CPPHY02

1. Cantilever- pin & microscope –Determination of Young's modulus
2. Carey Foster's Bridge-Measurement of resistivity
3. Symmetric Compound Pendulum-Determination of radius of gyration(K) and Acceleration due to gravity (g)
4. Surface tension - Capillary rise method
5. Half wave rectifier with and without filter-ripple factor and load regulation
6. Conversion of Galvanometer into voltmeter
7. Viscosity-constant pressure head- coefficient of viscosity (η) of the liquid
8. Spectrometer- Refractive Index of material of Prism
9. Field along the axis of a coil-Variation of magnetic field along the axis of a circular coil
10. Electro chemical equivalent of copper

SEMESTER III: 15U1CPPHY03

1. Cantilever – Scale and Telescope-Determination of Young's modulus
2. Carey Foster's Bridge-Temperature coefficient
3. Asymmetric Compound Pendulum-Determination of K and g
4. Spectrometer-refractive index of a liquid –Hollow prism
5. Diode Characteristics.
6. Potentiometer-Measurement of resistivity
7. Full wave rectifier using diode – Ripple factor and load regulation

8. Transistor characteristics- CE configuration
9. Gates AND,OR,NOT- Verification of Truth Table
10. Torsion pendulum - Rigidity modulus

SEMESTER IV: 15U1CPPHY04

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

SEMESTER V

(A) **15U1CPPHY05:**Classical and Quantum Mechanics

1. Fly Wheel – Moment of Inertia
2. Uniform bending – Young's Modulus-Optic lever method
3. Static torsion- Rigidity modulus
4. Viscosity- Stoke's method
5. Viscosity- Searle's rotation viscometer method
6. Thermal conductivity of rubber
7. Melde's String – Measurement frequency
8. Sonometer – Verification of laws, Measurement of density of solid.
9. A.C Sonometer- Frequency of a.c.
10. Liquid Lens- Refractive index of Liquid

(B) **15U1CPPHY06:** Physical Optics and Photonics

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

(C) **15U1CPPHY07:**Thermal and Statistical Physics

1. Characteristics of Zener diode
2. Voltage regulation using Zener diode

3. Voltage multiplier- Doubler and Tripler.
4. Characteristics of FET
5. Regulated power supply using IC 741
6. Wave shaping R C circuits - Integrator and differentiator
7. Diode clipper- Positive, Negative and Biased
8. Hartley Oscillator –frequency
9. Colpitt's oscillator –frequency
10. Phase shift oscillator- frequency

(D) **15U1CPPHY08:**Digital Electronics

1. Spectrometer – Grating- dispersive power
2. Spectrometer – Cauchy's constants
3. Newton's rings- Determination of wave length.
4. Laser- Determination of wave length
5. Ultrasonic- Determination of velocity of ultrasonic waves
6. Single slit – Diffraction using Laser
7. Verification of Thevenin's and Norton's theorem
8. Deflection and Vibration Magnetometer- m & B h
9. e/m – Thomson's apparatus- Bar magnet/magnetic focusing
10. B.G - Measurement of capacitance

SEMESTER VI

(A) **15U1CPPHY09:**Computational Physics

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

(B) **15U1CPPHY10:**Nuclear and Particle Physics

1. Universal gates IC – NAND,NOR-Realize basic gates from universal gates.
2. B.G. –Measurement of high resistance by leakage method
3. BCD to 7 segment decoder (IC)
4. Astable multivibrator – using transistor
5. Monostable multivibrator- using transistor
6. Monostable multivibrator – IC 555
7. 8085 Microprocessor – sorting in ascending and descending order.

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

(C) **15U1CPPHY11:** Condensed Matter Physics

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

(D) **15U1CPPHY12:** Relativity and Spectroscopy

1. D/A Converter using IC
2. 4 bit Shift register
3. Flip-Flop – R.S
4. J.K Flip-Flop
5. Schmitt trigger using 7414
6. Op- Amp – Inverter, non inverter and buffer.
7. 8085 Microprocessor - BCD addition and subtraction
8. 8085 Microprocessor – multiplication of two eight bit numbers with result 16 bit.
9. Computer programming – Solving a linear equation- Bisection method.10. Computer programming – Solving a equation by Newton – Raphson method
11. Computer programming- Generation of Fibonacci series

References:

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

SYLLABUS FOR PHYSICS PRACTICAL
COMPLEMENTARY PHYSICS FOR MATHEMATICS
A minimum of 8 experiments should be done in each practical course

SEMESTER I: 15U1CPPHY01

1. Vernier Calipers - Volume of a cylinder, sphere and a beaker
2. Screw gauge - Volume of a sphere and a glass plate
3. Beam balance - Mass of a solid (sensibility method)
4. Radius of a capillary tube- using (1) travelling microscope
5. Density of a liquid - U-Tube and Hare's apparatus
6. Viscosity of a liquid - Variable pressure head
7. Surface Tension – Capillary rise method.
8. Cantilever - Pin & Microscope – Determination of Young's Modulus
9. Symmetric Compound Pendulum-Determination of radius of gyration(K) and Acceleration due to gravity (g)
10. Spectrometer – Angle of the Prism.

SEMESTER II: 15U1CPPHY03

1. Cantilever – Scale and Telescope-Determination of Young's modulus
2. Asymmetric Compound Pendulum-Determination of K and g
3. Coefficient of Viscosity – Constant pressure head
4. Spectrometer - Refractive Index of material of prism.
5. Liquid lens - Refractive Index of glass using liquid of known refractive index
6. Potentiometer-Calibration of low range voltmeter
7. Characteristics of Zener diode
8. Construction of half wave rectifier with and without filter – Ripple factor and Load regulation
9. Mirror Galvanometer – Figure of merit
10. Torsion pendulum - Rigidity modulus

SEMESTER III: 15U1CPPHY05

1. Non-uniform bending-Young's modulus - Pin and Microscope method
2. Field along the axis of circular coil- Variation of magnetic field and determination of B H
3. Carey Foster's Bridge - Measurement of resistivity
4. Liquid lens - Refractive index of liquid
5. Searle's vibration Magnetometer-Magnetic moment
6. Tangent Galvanometer – Ammeter calibration
7. Spectrometer – Prism – Dispersive power
8. Potentiometer-Calibration of low range ammeter
9. Construction of full wave rectifier with and without filter – Ripple factor and

Load regulation
10. Construction of regulated power supply using Zener diode

SEMESTER IV: 15U1CPPHY07

1. Uniform bending –Young's modulus- Optic lever method
2. Torsion pendulum (Equal mass method) - Rigidity modulus and Moment of Inertia
3. Fly wheel - Moment of Inertia
4. Static Torsion - Rigidity modulus
5. Spectrometer - Grating Dispersive power
6. Newton's rings - Wave length
7. Deflection and Vibration Magnetometer- m & B h8. Conversion of Galvanometer into voltmeter
9. Transistor characteristics- CE configuration
10. Gates – AND , OR, NOT- verification of truth table
11. Construction of CE amplifier – gain

References

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

7. A text book of Practical Physics _ Indu Prakash and Ramakrishnan

SYLLABUS FOR PRACTICAL – COMPLEMENTARY COURSES
Complementary Physics for Chemistry
A minimum of 8 experiments should be performed in each practical course

SEMESTER I: 15U1CPPHY02

1. Vernier Calipers - Volume of a cylinder, sphere and a beaker
2. Screw gauge - Volume of a sphere and a glass plate
3. Beam balance - Mass of a solid (sensibility method)
4. Radius of a capillary tube- Using (1) travelling microscope
5. Density of a liquid - U-Tube and Hare's apparatus
6. Viscosity of a liquid - Variable pressure head
7. Surface Tension – Capillary rise method.
8. Cantilever - Pin & Microscope – Determination of Young's Modulus
9. Symmetric Compound Pendulum-Determination of radius of gyration(K) and Acceleration due to gravity (g)
10. Spectrometer – Angle of the Prism.

SEMESTER II: 15U1CPPHY04

1. Cantilever – Scale and Telescope-Determination of Young's modulus
2. Asymmetric Compound Pendulum-Determination of K and g
3. Coefficient of Viscosity – Constant pressure head
4. Spectrometer - Refractive Index of material of prism.
5. Liquid lens - Refractive Index of glass using liquid of known refractive index
6. Potentiometer-Calibration of low range voltmeter
7. Characteristics of Zener diode
8. Construction of half wave rectifier with and without filter – Ripple factor and Load regulation
9. Mirror Galvanometer – Figure of merit
10. Torsion pendulum - Rigidity modulus

SEMESTER III: 15U1CPPHY06

1. Non-uniform bending-Young's modulus-Pin and Microscope method
2. Field along the axis of circular coil- Variation of magnetic field and determination of B H
3. Carey Foster's Bridge - Measurement of resistivity
4. Liquid lens - Refractive index of liquid
5. Searle's vibration Magnetometer-magnetic moment
6. Tangent Galvanometer – Ammeter calibration
7. Spectrometer – Prism – Dispersive power
8. Potentiometer-Calibration of low range ammeter
9. Construction of full wave rectifier with and without filter – Ripple factor and

Load regulation
10. Construction of regulated power supply using Zener diode

SEMESTER IV: 15U1CPPHY08

1. Uniform bending – Young's modulus-Optic lever method
2. Torsion pendulum (Equal mass method) - Rigidity modulus and Moment of Inertia
3. Fly wheel - Moment of Inertia
4. Static Torsion - Rigidity modulus
5. Spectrometer - Grating Dispersive power
6. Newton's rings - Wave length
7. Deflection and Vibration Magnetometer- m & B h
8. Conversion of Galvanometer into voltmeter9. Transistor characteristics- CE configuration
10. Gates – AND , OR, NOT- verification of truth table
11. Construction of CE amplifier – gain

References

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

VIRTUAL LAB: SYLLABUS FOR B.Sc PHYSICS PRACTICAL – CORE COURSES

SEMESTER I

1. Angle of the prism using Spectrometer
2. Viscosity of a liquid-Variable pressure head
3. Spherometer- Determining the thickness of a glass plate; radius of curvature of a concave and convex lens.

SEMESTER II

1. Half-wave rectifier
2. Spectrometer-refractive index of material of a prism
3. Magnetic field along the axis of a circular coil carrying current

SEMESTER III

1. Lee's Disc Apparatus
2. Young's modulus- Non-uniform bending
3. Torsion pendulum-Rigidity modulus of the suspension wire

SEMESTER IV

1. Torsion Pendulum-moment of Inertia
2. Spectrometer-i-d curve
3. Compound pendulum-symmetric

SEMESTER V

1. Kater's pendulum
2. Diffraction grating
3. Thevenin's theorem

SEMESTER VI

1. Millikan's oil drop experiment
2. Newton's Law of cooling
3. Kundt's Tube experiment

VIRTUAL LAB: SYLLABUS FOR PHYSICS PRACTICAL – COMPLEMENTARY PHYSICS PRACTICAL FOR B.Sc MATHEMATICS AND B.Sc. CHEMISTRY

SEMESTER I

1. **Angle of the prism using Spectrometer**
2. **Torsion Pendulum-Rigidity modulus**
3. **Compound pendulum-symmetric**

SEMESTER II

1. **Half-wave rectifier**
2. **Spectrometer-refractive index of material of a prism**
3. **Diffraction grating**

4

PATTERN OF QUESTIONS

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

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

Pattern of questions for external examination for theory paper without practical.

	Total no. of questions	Number of questions to be answered	Marks of each question	Total marks
	10	10	1	10
	10	8	2	16
	7	5	5	25
	4	2	12	24
TOTAL	**31**	**25**	x	**75**

Pattern of questions for external examination for theory paper with practical.

	Total no. of questions	Number of questions to be answered	Marks of each question	Total marks
	10	10	1	10
	9	7	2	14
	6	4	4	16
	4	2	10	20
TOTAL	**29**	**23**	x	**60**