FACULTY OF SCIENCE

SYLLABI

FOR

B.Sc. (HONOUR SCHOOL) PHYSICS

1ST TO 6TH SEMESTER EXAMINATIONS

2014-2015

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OUTLINES OF TESTS, SYLLABUS AND COURSES OF READING FOR
B. Sc. (HONS SCHOOL) IN PHYSICS

<table>
<thead>
<tr>
<th>B.Sc. (H. S.) FIRST SEMESTER</th>
<th>MARKS</th>
<th>CREDITS</th>
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<tbody>
<tr>
<td>( Major )</td>
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<tr>
<td>PHYS 111H Mechanics</td>
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<td>PHYS 122H Electricity and Magnetism-II</td>
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Internal assessment and end semester examination will be of 20% and 80%, respectively of the total marks.

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<td>PHYS 212H Quantum Mechanics and Statistical Physics</td>
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<tr>
<td>PHYS 213H Electronics and Network Theory -I</td>
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<td>PHYS 222H Thermodynamics</td>
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<td>PHYS 223H Electronics and Network Theory -II</td>
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Internal assessment and end semester examination will be of 20% and 80%, respectively of the total marks.

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<td>PHYS 313H Condensed Matter Physics</td>
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<td>PHYS 314H Nuclear Physics</td>
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<tr>
<td>PHYS 315H Physics of Vacuum and Low temperature</td>
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<td>Course</td>
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<td>---------------------------------------------</td>
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<td>PHYS 322H Atomic and Molecular Physics</td>
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<td>3</td>
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<tr>
<td>PHYS 323H Material Science</td>
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<tr>
<td>PHYS 324H Particle Physics</td>
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<td>PHYS 325H Physics of Resonance Techniques</td>
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<tr>
<td>PHYS 326H Physics Laboratory</td>
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</table>

Internal assessment and end semester examination will be of 20% and 80%, respectively, of the total marks.

The students of B.Sc (Hons. School) in Physics will be studying the subject of “Environment and Road Safety Education”. This is a compulsory qualifying paper which the students are required to qualify in the 1st/2nd/3rd year of the course. The examination will be conducted by the University.

Besides the Major papers the students of B.Sc (Hons. School) in Physics will be studying the subsidiary papers in English, Mathematics, Computer Applications and Chemistry. The examination will be conducted by the respective Teaching Departments of the University.

Syllabi for the “Environment and Road Safety Education”, English and Physics (Major) subjects for B.Sc. (Hons. School) in Physics are given in this document. Syllabi for the Mathematics and Chemistry subsidiary are given at the University website under “complete syllabi” corresponding to B.Sc (Hons. School) in the respective subject. Syllabi for the Computer Applications subsidiary are given at the University website under “complete syllabi” corresponding to “Computer Subsidiary”.

Syllabi for the Physics subsidiary subjects for the B.Sc (Hons. School) in (Chemistry, Computer Science, Geology and Mathematics); and (Biochemistry, Biophysics, Biotechnology and Microbiology) are also given in the last part of the document.

**IMPORTANT NOTE:**

The Paper of Environment & Road Safety Education is a compulsory qualifying paper, which the students have to study in the B.A./B.Sc. 1st year (2nd Semester). If the student/s failed to qualify the paper during the 2nd Semester. he/she/they be allowed to appear/qualify the same in the 4th or 6th Semester/s.
# B.Sc. (H. S.) in Physics - Subsidiary Courses

## FIRST SEMESTER

<table>
<thead>
<tr>
<th>Paper</th>
<th>Marks</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Preliminary English</td>
<td>100</td>
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<tr>
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<td>Chemistry : Practical</td>
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<tr>
<td>Mathematics : Theory Paper</td>
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<tr>
<td>MATH105S: Algebra and Geometry</td>
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<td>Mathematics : Theory Paper</td>
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<tr>
<td>MATH115S: Advanced Calculus and Geometry</td>
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## SECOND SEMESTER

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<td>MATH125S: Calculus</td>
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## THIRD SEMESTER

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<td>MATH205S: Matrices</td>
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<td>Mathematics : Theory Paper</td>
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<td>(For students with background in Mathematics)</td>
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<tr>
<td>Computer Science : Theory Paper A</td>
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<td>Computer Applications</td>
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## FOURTH SEMESTER

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<td>MATH205S: Matrices</td>
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<td>Mathematics : Theory Paper</td>
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<td>MATH215S: Diff. eqns., Fourier series, Integral transforms &amp; Complex analysis</td>
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<td>(For students with background in Mathematics)</td>
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<tr>
<td>Computer Science : Paper B</td>
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<tr>
<td>Numerical Meth. &amp; Fortran programming</td>
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<tr>
<td>Computer Science : Paper D - Practicals</td>
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OUTLINES OF TESTS, SYLLABUS OF PHYSICS FOR B. Sc. (HONS SCHOOL) IN (CHEMISTRY, COMPUTER SCIENCE, GEOLOGY AND MATHEMATICS), and (BIOCHEMISTRY, BIOPHYSICS, BIOTECHNOLOGY AND MICROBIOLOGY)

FIRST SEMESTER SUBSIDIARY FOR STUDENTS OF B.SC (HONS. SCHOOL) IN CHEMISTRY, COMPUTER SCIENCE, GEOLOGY AND MATHEMATICS

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<th>Course Code</th>
<th>Course Title</th>
<th>Marks</th>
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<td>Mechanics and Waves</td>
<td>75</td>
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<td>PHYS 112S</td>
<td>Physics Laboratory</td>
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SECOND SEMESTER SUBSIDIARY FOR STUDENTS OF HONS. SCHOOL IN CHEMISTRY, COMPUTER SCIENCE, GEOLOGY AND MATHEMATICS

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<th>Course Title</th>
<th>Marks</th>
<th>Credits</th>
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<td>PHYS 121S</td>
<td>Optics and Thermal Physics</td>
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FIRST SEMESTER SUBSIDIARY FOR STUDENTS OF HONS. SCHOOL IN BIOCHEMISTRY, BIOPHYSICS, BIOTECHNOLOGY AND MICROBIOLOGY

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<th>Course Code</th>
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SECOND SEMESTER SUBSIDIARY FOR STUDENTS OF HONS. SCHOOL IN BIOCHEMISTRY, BIOPHYSICS, BIOTECHNOLOGY AND MICROBIOLOGY

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THIRD SEMESTER SUBSIDIARY FOR STUDENTS OF HONS. SCHOOL IN CHEMISTRY, COMPUTER SCIENCE, GEOLOGY AND MATHEMATICS

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FOURTH SEMESTER SUBSIDIARY FOR STUDENTS OF HONS. SCHOOL IN CHEMISTRY, COMPUTER SCIENCE, GEOLOGY AND MATHEMATICS

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ENVIRONMENT AND ROAD SAFETY EDUCATION (SEMESTER – II)

UNIT I (ENVIRONMENT)

Note: The syllabus has 15 topics to be covered in 25 hour lectures in total, with 2 lectures in each topic from 2 to 11 and one each for the topics 1 and 12 to 15.

1. Environment Concept:
   Introduction, concept of biosphere—lithosphere, hydrosphere, atmosphere; Natural resources—their need and types; principles and scope of Ecology; concepts of ecosystem, population, community, biotic interactions, biomes, ecological succession.

2. Atmosphere:
   Parts of atmosphere, components of air; pollution, pollutants, their sources, permissible limits, risks and possible control measures.

3. Hydrosphere:
   Types of aquatic systems. Major sources (including ground water) and uses of water, problems of the hydrosphere, fresh water shortage; pollution and pollutants of water, permissible limits, risks and possible control measures.

4. Lithosphere:
   Earth crust, Soil—a life support system, its texture, types, components, pollution and pollutants, reasons of soil erosion and possible control measures.

5. Forests:
   Concept of forests and plantations, types of vegetation and forests, factors governing vegetation, role of trees and forests in environment, various forestry programmes of the Govt. of India, Urban Forests, Chipko Andolan.

6. Conservation of Environment:
   The concepts of conservation and sustainable development, why to conserve, aims and objectives of conservation, policies of conservation; conservation of life support systems—soil, water, air, wildlife, forests.

7. Management of Solid Waste:
   Merits and demerits of different ways of solid waste management—open, dumping, landfill, incineration, resource reduction, recycling and reuse, vermicomposting and vermiculture, organic farming.

8. Indoor Environment:
   Pollutants and contaminants of the in-house environment; problems of the environment linked to urban and rural lifestyles; possible adulterants of the food; uses and harms of plastics and polythene; hazardous chemicals, solvents and cosmetics.

9. Global Environmental Issues:
   Global concern, creation of UNEP; Conventions on climate change, Convention on biodiversity; Stratospheric ozone depletion, dangers associated and possible solutions.
10. **Indian Laws on Environment:**
Indian laws pertaining to Environmental protection: Environment (Protection) Act, 1986; General information about Laws relating to control of air, water and noise pollution. What to do to seek redressal.

11. **Biodiversity:**
What is biodiversity, levels and types of biodiversity, importance of biodiversity, causes of its loss, how to check its loss; Hotspot zones of the world and India, Biodiversity Act, 2002.

12. **Noise and Microbial Pollution:**
Pollution due to noise and microbes and their effects.

13. **Human Population and Environment:**

14. **Social Issues:**
Environmental Ethics: Issues and possible solutions, problems related to lifestyle, sustainable development; Consumerisms and waste generation.

15. **Local Environmental Issues:**
Environmental problems in rural and urban areas, Problem of Congress grass & other weeds, problems arising from the use of pesticides and weedicides, smoking etc.

**Practicals:**
Depending on the available facility in the college, a visit to Vermicomposting units or any other such non-polluting eco-friendly site or planting/caring of vegetation/trees could be taken.

**Examination Pattern:**
A qualifying paper of 50 marks comprising of fifty multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong answer or unattempted question), and of 1 hour duration.

The students have to obtain 33% marks to qualify the paper. The marks are not added/included in the final mark sheet.

**UNIT II (ROAD SAFETY)**

1. Concept and Significance of Road Safety.
2. Role of Traffic Police in Road Safety.
3. Traffic Engineering – Concept & Significance.
5. How to obtain Driving License.
7. Common Driving mistakes.
8. Significance of First-aid in Road Safety.
9. Role of Civil Society in Road Safety.
Note: Examination Pattern:

- The Environment and Road Safety paper is 70 marks.
- Seventy multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong or un-attempted questions).
- The paper shall have two units: Unit I (Environment) and Unit II (Road Safety).
- Unit II shall comprise of 20 questions with minimum of 1 question from each topics 1 to 10.
- The entire syllabus of Unit II is to be covered in 10 hours.
- All the questions are to be attempted.
- Qualifying Marks 33 per cent i.e. 23 marks out of 70.
- Duration of examination: 90 minutes.
- The paper setter is requested to set the questions strictly according to the syllabus.

Suggested Readings
2. Road Safety Signage and Signs (2011), Ministry of Road Transport and Highways, Government of India.

Websites:
(a) www.chandigarhpolice.nic.in
(b) www.punjabpolice.gov.in
(c) www.haryanapolice.gov.in
(d) www.hppolice.nic.in
Outlines of tests syllabi and courses of reading for B.Sc. (Honours School) First Year English Subsidiary (Semester System)

First Semester

Objectives:
The objective of teaching English to the science students is to create general awareness among them about literature and its impact on their lives. At the same time, it is expected that the students, on reading this course, shall develop proficiency in reading and writing skills, while acquiring a sensitive and analytical attitude towards literature in particular, and life in general. It is with this aim in mind that the new text has been selected and it is hoped that the objectives of the course will not only be reflected but also realized through necessary shift in the teaching practices, design of the question paper and mode of evaluation.

Note:
(i) There will be one paper of 80 marks, 10 marks are reserved for the Internal Assessment and 10 for the Practical Work. Total is 100.
(ii) The paper shall consist of Two Units. Unit I will be text specific and Unit II shall deal with different aspects of communications and language learning skills.
(iii) For Unit I, the prescribed text is Varieties of Expression, Ed. A. H. Tak, Foundation Books, which shall replace the existing text Patterns in Prose by Jagdish Chander, P.U., Chandigarh. It may be pointed out here that only certain sections of this text i.e. prose and drama are prescribed. Poetry has been deleted completely. Only five prose and five plays have been recommended for the study. The relevant sections, however, are as follows:

Prose:
I. The Judgement Seat of Vikramaditya, Sister Nivedita
II. Engine Trouble, R. K. Narayan
III. The Conjurer’s Revenge, Stephen Leacock

Drama:
I. The Rising of the Moon, Lady Gregory
II. Waterloo, Arthur Conan Doyle

(iv) No text book is recommended for Unit II, but a few books that may be used for this Unit are listed towards the end.

Communication: It shall focus on different aspects of communication, types of communication, and significance of positive attitude in improving communication.

Writing Skills: This section shall focus on précis-writing, letters of all kinds; curriculum vitae, short, formal reports (no exceeding 200 words); public notices and advertisements relating to product promotion etc.

Modern Forms of Communication: Here special emphasis shall be given to teaching the format of e-mails, fax messages, telegrams, audio-visual aids and power-point presentations. Apart from this, the students shall also be given basic lessons in effective listening, non-verbal communication, how to prepare for an interview and group discussion etc.
Practical work:-
Teacher should assign some project or practical work to the students. This should be in the nature of guided activity, which the students shall have to complete under the direct supervision of the teacher. The students may be given projects on a variety of subjects relating to their discipline i.e. science in general or a specific area of science they are specializing in. Preferably, they should be given minor projects (to be completed within less than two weeks, and length not exceeding 20 pages) in consultation with teachers of science. However, the evaluation of the projects should be done only by the Language Teachers, who must keep all the basic criteria of good writing in mind while doing so.

Note: In case of private candidates and students of School of Open Learning, the marks obtained by them out of 80 will be proportionately increased out of 100.

Testing Scheme:
The examination paper shall be divided into two sections, corresponding to two units already proposed in the syllabus. The distribution of questions and marks in Section I shall be as follows:

Section I (It is text-based and corresponds to unit I in the syllabus)
Q1. It shall consist of five short questions (not exceeding 100-120 words) out of which a student will be expected to attempt any three. This question shall be based upon the prescribed text Varieties of Expression and cover a wide range of issues, topics and problems. It shall consist of 12 marks.
Q2. It shall consist of two long questions (not exceeding 300-350 words) out of which a student will be expected to attempt only one. This question shall have internal choice, be based upon the prescribed text Varieties of Expression. This shall carry 10 marks.

Note: The question 1 & 2 should be so designed as to cover all the chapters prescribed, as well as the major issues and problems listed therein.

Q3. It shall consist of an Unseen Passage for Comprehension (not more than 800 words), with minimum six questions at the end. These questions should be designed in such a way that we are able to test a student’s comprehension ability, language/presentation skills and vocabulary etc. This question shall be of 12 marks.
Q4. It shall exclusively be a test of vocabulary, but designed strictly on the lines of various exercises given at the end of each chapter in the prescribed text. The candidate shall be given six words in one column and asked to match them with words/meanings in the next column, This shall carry 6 marks.

Section II (Based upon Unit II)
Q5 (a) The students shall be asked to write a short survey report on a situation, incident, problem of science or the possibility of starting a new scientific venture (in about 150-200 words). The students shall be given an internal choice in this question. This question shall carry 8 marks.
Q5 (b) This question shall be on notices/advertisements of various types (as mentioned in the syllabus). It'll carry 4 marks.
Q.6. This question shall test a student’s ability to write letters of various kinds (in nor more than 250 words). Again, there will be internal choice here and the question will be of 8 marks.

Q.7 There will test a student’s ability to write a Précis. A passage of about 200 words shall be given and the students shall have to write a précis of about 70 words (including the title). This question shall carry 10 marks.

Q.8 This question shall test a student’s understanding of various aspects of communication and modern forms of communication. It shall be divided into two parts:
(a) Two short questions to be attempted (in not more than 100-120 words each) on different aspects of communication. It’ll carry 6 marks.
(b) Definitions/format of modern forms of communication to be tested. This shall again carry 4 marks.

Suggested Reading:

SECOND SEMESTER

Objectives:
The objective of teaching English to the science students is to create general awareness among them about literature and its impact on their lives. At the same time, it is expected that the students, on reading this course, shall develop proficiency in reading and writing skills, while acquiring a sensitive and analytical attitude towards literature in particular, and life in general. It is with this aim in mind that the new text has been selected and it is hoped that the objectives of the course will not only be reflected but also realized through necessary shift in the teaching practices, design of the question paper and mode of evaluation.

Note:
(i) There will be one paper of 80 marks, 10 marks are reserved for the Internal Assessment and 10 for the Practical Work. Total is 100.
(ii) The paper shall consist of Two Units. Unit I will be text specific and Unit II shall deal with different aspects of communications and language learning skills.
(iii) For Unit I, the prescribed text is Varieties of Expression, Ed. A. H. Tak, Foundation Books, which shall replace the existing text Patterns in Prose by Jagdish Chander, P.U., Chandigarh. It may be pointed out here that only certain sections of this text i.e prose and drama are prescribed. Poetry has been deleted completely. Only five prose and five plays have been recommended for the study. The relevant sections, however, are as follows:

Prose:
I J. C. Bose, Aldous Huxley
II The Position of Women in Ancient India, Padmini Sen Gupta

Drama:
I The Proposal, Anton Chekhov
II Riders to the Sea, J. M. Synge
III Lithuania, Rupert Brooke
(iv) No text book is recommended for Unit II, but a few books that may be used for this Unit are listed towards the end Unit II shall consist of the following:

*Communication:* It shall focus on different aspects of communication, types of communication, and significance of positive attitude in improving communication.

*Writing Skills:* This section shall focus on précis-writing, letters of all kinds; curriculum vitae, short, formal reports (no exceeding 200 words); public notices and advertisements relating to product promotion etc.,

*Modern Forms of Communication:* Here special emphasis shall be given to teaching the format of e-mails, fax messages, telegrams, audio-visual aids and power-point presentations. Apart from this, the students shall also be given basic lessons in effective listening, non-verbal communication, how to prepare for an interview and group discussion etc.,

**Practical work:-**
Teacher should assign some project or practical work to the students. This should be in the nature of guided activity, which the students shall have to complete under the direct supervision of the teacher. The students may be given projects on a variety of subjects relating to their discipline i.e. science in general or a specific area of science they are specializing in. Preferably, they should be given minor projects (to be completed within less than two weeks, and length not exceeding 20 pages) in consultation with teachers of science. However, the evaluation of the projects should be done only by the Language Teachers, who must keep all the basic criteria of good writing in mind while doing so.

**Note:** In case of private candidates and students of School of Open Learning, the marks obtained by them out of 80 will be proportionately increased out of 100.

**Testing Scheme:**
The examination paper shall be divided into two sections, corresponding to two units already proposed in the syllabus. The distribution of questions and marks in Section I shall be as follows:

**Section I** (It is text-based and corresponds to unit I in the syllabus).

Q1. It shall consist of five short questions (not exceeding 100-120 words) out of which a student will be expected to attempt any three. This question shall be based upon the prescribed text *Varieties of Expression* and cover a wide range of issues, topics and problems. It shall consist of 12 marks.

Q2. It shall consist of two long questions (not exceeding 300-350 words) out of which a student will be expected to attempt only one. This question shall have internal choice, be based upon the prescribed text *Varieties of Expression*. This shall carry 10 marks.

**Note:** The question 1 & 2 should be so designed as to cover all the chapters prescribed, as well as the major issues and problems listed therein.

Q3. It shall consist of an Unseen Passage for Comprehension (not more than 800 words), with minimum six questions at the end. These questions should be designed in such a way that we are able to test a student’s comprehension ability, language/presentation skills and vocabulary etc. This question shall be of 12 marks.

Q.4. It shall exclusively be a test of vocabulary, but designed strictly on the lines of various exercises given at the end of each chapter in the prescribed text. The candidate shall be given six words in one column and asked to match them with words/meanings in the next column, This shall carry 6 marks.
Section II (Based upon Unit II)

Q.5 (a) The students shall be asked to write a short survey report on a situation, incident, problem of science or the possibility of starting a new scientific venture (in about 150-200 words). The students shall be given an internal choice in this question. This question shall carry 8 marks.

(b) This question shall be on notices/advertisements of various types (as mentioned in the syllabus). It’ll carry 4 marks.

Q.6. This question shall test a student’s ability to write letters of various kinds (in not more than 250 words). Again, there will be internal choice here and the question will be of 8 marks.

Q.7 There will test a student’s ability to write a Précis. A passage of about 200 words shall be given and the students shall have to write a précis of about 70 words (including the title). This question shall carry 10 marks.

Q.8 This question shall test a student’s understanding of various aspects of communication and modern forms of communication. It shall be divided into two parts:

(a) Two short questions to be attempted (in not more than 100-120 words each) on different aspects of communication. It’ll carry 6 marks.

(b) Definitions/format of modern forms of communication to be tested. This shall again carry 4 marks.

Suggested Reading:
PHYSICS SYLLABUS FOR B.SC. (HONS. SCHOOL)
FIRST SEMESTER FOR STUDENTS OF PHYSICS (MAJOR)

PHYS 111H MECHANICS (45 hrs.) Max. Marks: 15+60 = 75

Objective: This course has been so framed that the students are first exposed to the mathematical tools needed in Mechanics and Special Relativity. Students are then taught the topics of conservation laws, elastic and inelastic scattering, dynamics of rigid bodies and inverse-square law of forces in the framework of Newtonian Mechanics.

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Mathematical Tools: Differentiation : Basic ideas, the chain rule, implicit differentiation, special points of a function. Differential Equations: First degree first order equations, exact differentials, integrating factor, second order homogeneous and non-homogeneous differential equations with constant coefficients, complementary solutions and particular integral. Integration: As area under the curve and inverse of differentiation, simple examples, integration by substitution and by parts, reduction formulae, integration in plane polar coordinates.

Vectors : Basics, vector addition, products of vectors (Scalar and Vector), reciprocal vectors, vector derivatives, circular motion, vectors and spherical polar coordinates, invariants.

Conservation Laws: Conservation of Energy, Conservative forces, Internal forces and conservation of linear momentum, Centre of mass, systems with variable mass, Space-Vehicle Problem. Conservation of Angular Momentum, Internal torques, Angular Momentum about the Centre of mass, Rotational invariance, Shape of Galaxy.

Elastic and Inelastic Scattering : Types of scattering and conservation laws, Laboratory and centre of mass systems, collision of particles which stick together, General elastic collision of particles of different mass, Cross-section of elastic scattering, Rutherford scattering.

Dynamics of Rigid Bodies : Equation of motion, angular momentum and kinetic energy of a Rotating Body, Moment of Inertia and Radius of Gyration, Rotation of about fixed axes - time dependence of motion, cylinder on an accelerated rough plane, Behaviour of angular momentum vector, Principal axes and Euler’s equations.

Elementary Gyroscope, Symmetrical Top.

Inverse-Square-Law of Forces : Force between a Point Mass and Spherical shell. Force between a Point Mass and Solid Sphere, Gravitational and Electrostatic self-energy. Gravitational energy of the Galaxy and of uniform sphere; Orbits and their eccentricity, Two-body problem - reduced mass. (Ch. IX of Book 2, Ch. 6 of Book 3).

TUTORIALS : Relevant problems given at the end of a chapter in books 1, 2 and 3.
Recommended Books:

PHYS 112H ELECTRICITY AND MAGNETISM-I (45 hrs.) Max. Marks: 15+60 = 75

Objective: The aim of this course is to teach the students basics of electronics and electric current after making them comfortable with the mathematical tools involved in the study of electricity and magnetism.

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Mathematical Tools: Complex Numbers: Real and imaginary parts, complex plane, polar representation, conjugation, algebraic operations, Euler’s formula, power and roots of complex numbers, exponential and trigonometric functions, hyperbolic functions, logarithms, inverse functions. Vector Calculus: Differentiation of vectors, scalar and vector fields, conservative fields and potentials, line integrals, gradient of a scalar field, divergence of a vector field and divergence theorem, curl of a vector field and its physical significance, Stokes’ theorem, combination of grad, div and curl.


Electric Potential: Potential as line integral of field, potential difference, Gradient of a scalar function, Derivation of the field from the potential, potential of a charge distribution, Uniformly charged disc. Force on a surface charge, energy associated with an electric field, Gauss’s theorem and differential form of Gauss’s law, Laplacian and Laplace’s equation, Poisson’s equation.

Electric Fields Around Conductors: Conductors and insulators, General electrostatic problem. Boundary conditions, Uniqueness theorem, some simple system of conductors; capacitors and capacitance, Energy stored in a capacitor.

Electric Currents: Charge transport and current density, Stationary currents, Ohm’s law, Electrical conduction model, Failure of Ohm’s law, Circuits and circuit elements, Energy dissipation in current flow, variable currents in capacitors and resistors.

Tutorials: Relevant problems given at the end of each chapter in books 1,2 and 3.
**Recommended Books:**

**PHYS 113H PHYSICS LABORATORY (90 hrs.) Max. Marks: 10+40 = 50**

**Objective:** The laboratory exercises have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipments.

**Note:**
(i) Examination time will be 3 hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class, and number of experiments performed.
(ii) There will be a 30 minutes written comprehensive test containing short answer questions for the whole class before the actual laboratory examination. This test will have a weightage of 10 marks and will be jointly set by the teachers involved in the examination and will be of general nature.
(iii) Eight to ten experiments are to be performed in first Semester. Experiments performed in first semester can not be repeated in second semester.

**List of Experiments:**

Experimental skills: General Precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a straight line, and Error analysis, Significant figures and interpretation of results.

1. Use of Vernier callipers, Screw gauge, Spherometer, Barometer, Sphygmanomanometer, Lightmeter, dry and wet thermometer, TDS/conductivity meter and other measuring instruments based on applications of the experiments. Use of Plumb line and Spirit level.
2. To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and to determine:
   (i) Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length.
   (ii) The value of g in the laboratory.
3. Determination of ‘g’ by Kater’s pendulum.
5. To study moment of inertia of a flywheel.
6. Determination of height (of inaccessible structure) using sextant.
7. Determination of modulus of rigidity by static method.
8. Determination of modulus of rigidity by (i) dynamic method Maxwell's needle/Torsional pendulum; (ii) Forced torsional oscillations excited using electromagnet.
10. To determine the Young’s modulus by (i) bending of beam using traveling microscope/laser, (ii) Flexural vibrations of a bar.
11. To study one dimensional collision using two hanging spheres of different materials.
12. Dependence of scattering angle on kinetic energy and impact parameter in Rutherford scattering (mechanical analogue).
13. To measure the coefficient of linear expansion for different metals and alloys.
15. To study the magnetic field produced by a current carrying solenoid using a pick-up coil/Hall sensor and to find the value of permeability of air.
16. To determine the frequency of A.C. mains using sonometer.
17. To study given source of electrical energy and verify the maximum power theorem.
18. To determine the resistance of an electrolyte for A.C current and study its concentration dependence. Also to study temperature dependence.
19. Study of temperature dependence of conductor and semiconductor (FET channel).
20. To measure thermo e.m.f. of a thermocouple as a function of temperature and find inversion temperature.
21. To study C.R.O. as display and measuring device by recording sines and square waves, output from a rectifier, verification (qualitative) of law of electromagnetic induction and frequency of A.C. mains.
22. To plot the Lissajous figures and determine the phase angle by C.R.O.
23. To study B-H curves for different ferromagnetic materials using C.R.O.
24. Determination of given inductance by Anderson's bridge.
25. Determination of low inductance by Maxwell-Wein bridge.
26. To determine the value of an air capacitance by de-Sauty Method and to find permittivity of air. Also to determine the dielectric constant of a liquid.
27. To study temperature coefficient of resistance of Cu.
28. Study of R.C. circuit with varying e.m.f. using it as an integrating circuit.
29. Study of R.C. circuit with a low frequency a.c. source.
30. Studies based on LCR Board: Impedance of LCR circuit and the phase and between voltage and current.
31. To measure Laser beam parameters for a He-Ne laser and semiconductor LASER.
32. To study diffraction from single slit, double slit and diffraction grating. Study of diffraction patterns using mesh, wire, scale graduations, screw and various apertures.
33. (a) To study Photoelectric effect using Photocell (b) inverse-square law (concept of solid angle).
34. To study Malus's law of polarization.
PHYSICS SYLLABUS FOR B.Sc. (HONS. SCHOOL)
SECOND SEMESTER FOR STUDENTS OF PHYSICS (MAJOR)

PHYS 121H SPECIAL THEORY OF RELATIVITY (45 hrs.)     Max. Marks: 15+60 = 75

Objective: This course aims at exposing the students to Newton’s law of motion, the Galilean transformations and Einstein’s special theory of relativity in proper perspective so that they can use its formulation in later courses.

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Newton’s Laws of Motion: Forces and equations of motion, Lorentz force, Motion of a charged particle in a uniform constant electric field, Charged particle in a uniform alternating electric field. Charged particle in a uniform magnetic field.

Galilean Transformation: Inertial reference frames, absolute and relative accelerations and velocity, Galilean Transformation, Foucault’s pendulum, Conservation of Momentum, Fictitious Forces, Collisions, Velocity and Acceleration in Rotating coordinate systems.

Lorentz Transformations: Michelson-Morley Experiment, Basic postulates of special relativity, Lorentz transformations, Simultaneity and causality in relativity. Length contraction, Time dilation, Velocity Transformation, Space-like and time-like intervals, Aberration of light, relativistic Doppler effect.


Problems in Relativistic Dynamics: Acceleration of Charged Particle by constant longitudinal electric field, Acceleration by a Transverse Electric field, charged particle in a magnetic field, centre of mass system and Threshold Energy. Energy available from Moving charge, Antiproton Threshold, Photoproduction of mesons.


TUTORIALS: Relevant problems given at the end of a chapter in books 1, 2 and 3.

Recommended Books
PHYS 122H ELECTRICITY AND MAGNETISM-II (45 hrs.) Max. Marks: 15+60 = 75

Objective: The course on Electricity & Magnetism-II has been designed to make the students confident about electric fields in matter, the fields of moving charges, magnetic fields in vacuum as well as matter, the physics of electromagnetic induction and alternating currents so that they can use this knowledge in electric and condense matter physics

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Electric Fields in Matter: Dielectrics, Moments of a charge distribution, Potential and field of a dipole, Atomic and molecular dipoles, Induced dipole moments, Permanent dipole moments, electric field caused by polarized matter, field of a polarized sphere, dielectric sphere in a uniform field, Gauss’s law and a dielectric medium, Electrical susceptibility and atomic polarizability, Energy changes in polarization, Polarization in changing fields.

The Fields of Moving Charges: Magnetic forces, Measurement of a charge in motion, invariance of charge, Electric field measured in different frames of reference, Field of a point charge moving with constant velocity, Field of a charge that starts or stops, Force on a moving charge, Interaction between a moving charge and other moving charges.

Magnetic Field: Definition, some properties of the magnetic field, Vector potential, Field of current carrying wire and solenoid, change in $B$ at a current sheet; Transformations of electric and magnetic fields. Rowland’s experiment, Hall effect.


Alternating Current Circuits: A resonance circuit, Alternating current, A.C. networks, Admittance and impedance, skin effect, power and energy in A.C. circuits, Anderson’s Bridge, Q factor for series resonance.

Magnetic Fields in Matter: Response of various substances to magnetic field, Force on a dipole in an external field, Electric currents in Atoms, Electron spin and Magnetic moment, types of magnetic materials, Magnetic susceptibility.

Tutorials: Relevant problems given at the end of each chapter in following books.

Recommended Books:
1. Electricity and Magnetism (Berkley, Phys. Course 2): E.M. Purcell (Tata McGraw Hill), 2nd ed. 1985,
Objective: The laboratory exercises have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipments.

Note:
(i) Examination time will be 3 hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class and number of experiments performed.
(ii) There will be a 30 minutes written comprehensive test containing short answer questions for the whole class before the actual laboratory examination. This test will have a weightage of 10 marks and will be jointly set by the teachers involved in the examination and will be of general nature.
(iii) Eight to ten experiments are to be performed in second Semester. Experiments performed in first semester can not be repeated in second semester. The list of the experiments is same as given in PHYS 113 LABORATORY Course.

List of Experiments:

Experimental skills: General Precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a straight line, and Error analysis, Significant figures and interpretation of results.

1. Use of Vernier callipers, Screw gauge, Spherometer, Barometer, Sphygmomanometer, Lightmeter, dry and wet thermometer, TDS/conductivity meter and other measuring instruments based on applications of the experiments. Use of Plumb line and Spirit level.
2. To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and to determine:
   (i) Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length.
   (ii) The value of g in the laboratory.
3. Determination of ‘g’ by Kater’s pendulum.
5. To study moment of inertia of a flywheel.
6. Determination of height (of inaccessible structure) using sextant.
7. Determination of modulus of rigidity by static method.
8. Determination of modulus of rigidity by (i) dynamic method Maxwell's needle/Torsional pendulum; (ii) Forced torsional oscillations excited using electromagnet.
10. To determine the Young’s modulus by (i) bending of beam using traveling microscope/laser, (ii) Flexural vibrations of a bar.
11. To study one dimensional collision using two hanging spheres of different materials.
12. Dependence of scattering angle on kinetic energy and impact parameter in Rutherford scattering (mechanical analogue).
13. To measure the coefficient of linear expansion for different metals and alloys.
15. To study the magnetic field produced by a current carrying solenoid using a pick-up coil/Hall sensor and to find the value of permeability of air.
16. To determine the frequency of A.C. mains using sonometer.
17. To study given source of electrical energy and verify the maximum power theorem.
18. To determine the resistance of an electrolyte for A.C current and study its concentration dependence. Also to study temperature dependence.
19. Study of temperature dependence of conductor and semiconductor (FET channel).
20. To measure thermo e.m.f. of a thermocouple as a function of temperature and find inversion temperature.
21. To study C.R.O. as display and measuring device by recording sines and square waves, output from a rectifier, verification (qualitative) of law of electromagnetic induction and frequency of A.C. mains.
22. To plot the Lissajous figures and determine the phase angle by C.R.O.
23. To study B-H curves for different ferromagnetic materials using C.R.O.
24. Determination of given inductance by Anderson's bridge.
25. Determination of low inductance by Maxwell-Wein bridge.
26. To determine the value of an air capacitance by de-Sauty Method and to find permittivity of air. Also to determine the dielectric constant of a liquid.
27. To study temperature coefficient of resistance of Cu.
28. Study of R.C. circuit with varying e.m.f. using it as an integrating circuit.
29. Study of R.C. circuit with a low frequency a.c. source.
30. Studies based on LCR Board: Impedance of LCR circuit and the phase and between voltage and current.
31. To measure Laser beam parameters for a He-Ne laser and semiconductor LASER.
32. To study diffraction from single slit, double slit and diffraction grating. Study of diffraction patterns using mesh, wire, scale graduations, screw and various apertures.
33. (a) To study Photoelectric effect using Photocell (b) inverse-square law (concept of solid angle).
34. To study Malus's law of polarization.
PHYSICS SYLLABUS FOR B.SC. (HONS. SCHOOL)
THIRD SEMESTER FOR STUDENTS OF PHYSICS (MAJOR)

PHYS 211H : VIBRATIONS AND WAVES (45 hrs.)       Max. Marks: 15+60 = 75

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

I Simple Harmonic Free Vibrations : Simple harmonic motion, energy of a SHO, Compound pendulum, Electrical Oscillations, Plasma Vibrations, Lattice Vibrations, Transverse Vibrations of a mass on a string, composition of two perpendicular SHMs of same period and of periods in ratio 1:2, Anharmonic Oscillations.


III Forced Vibrations and Resonance: A forced oscillator, Transient and Steady State Oscillations, velocity versus driving force frequency, Resonance, power supplied to forced oscillator by the driving force. Q-factor of a forced oscillator, Electrical, nuclear and nuclear-magnetic resonances.

IV Coupled Oscillations: Stiffness coupled oscillators, Normal coordinates and modes of vibrations. Normal frequencies, Forced vibrations and resonance for coupled oscillators, Masses on string-coupled oscillators.

V Waves in Physical Media: Wave motion in one dimension, Transverse and longitudinal waves, progressive harmonic waves and their energy, Transverse waves on a string, longitudinal waves on a rod, Electrical transmission lines, characteristic impedance of a string and a transmission line, waves in an absorbing medium, spherical waves.

VI Reflection and Transmission: Reflection and transmission of transverse waves on a string at the discontinuity, Energy considerations of reflected and transmitted waves, Impedance matching, eigen frequencies and eigen functions for stationary waves on a string. Normal modes in three dimensions, transmission of non-monochromatic waves, Bandwidth Theorem.

TUTORIALS : Relevant Problems on the topics covered in the course.

Recommended Books
PHYS 212H: QUANTUM MECHANICS AND STATISTICAL PHYSICS (45 hrs.)

Max. Marks: 15+60 = 75

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

I Mathematical Tools : Partial differentiation : Definition of partial derivative, total differentiation, exact and inexact differentials, useful theorems, the chain rule, change of variables, stationary values under constraints, Lagrange multipliers, differentiation of integrals.

II Origin of the Quantum Theory : Blackbody radiation, the photoelectric effect, the Franck-Hertz experiment, the correspondence principle, the Bohr atom, quantization of the phase integral, the particle in a box, the rigid rotator, the harmonic oscillator.

III Foundations of Wave Mechanics : Photons as particles: the Compton effect, particle diffraction, elements of Fourier Analysis, Parseval’s formula and the Fourier integral theorem, examples of Fourier transforms, superposition of plane waves and time dependence, wavepackets and the Einstein-de Broglie relations, wave functions for a free particle and the Schrodinger equation, physical interpretation of the Schrodinger wave function.

IV Basic Ideas of Statistical Physics : Introduction, Basic ideas of probability and their applications, Macrostates and microstates, Effect of constraints on the system. Distribution of n particles in two compartments, deviation from the state of maximum probability, Equilibrium state of a dynamic system, distribution of N distinguishable particles in unequal compartments, Division into cells.


TUTORIALS : Relevant Problems given at the end of chapters in books 1 - 4.

Recommended Books:
PHYS 213H: ELECTRONICS AND NETWORK THEORY-I (45 hrs.)

Max. Marks: 15+60 = 75

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.


Semiconductor Materials and Diode Junctions: Band diagram, Mobility and conductivity, generation and recombination of charges, Diffusion, Continuity equation Diode equation, v-i characteristics, temperature dependence, Transition and diffusion capacitance, Zener diode, Light emitting diode, various kinds of semiconductor and diode-junction based transducers

Transistors: pnp and npn junction transistors, transistor current components, CB, CC and CE configurations, transfer characteristics, Transistor as switch and applications, Transistor switching time; Transistor biasing circuits - fixed bias, emitter-stabilised biasing, Voltage-divider biasing, Stability of I_CO, V_BE and beta, Junction FET, v-i Characteristics.

Waveshaping Circuits: Diode and transistor based Clipping and Clamping circuits, Clamping circuit theorem.

Power Supplies: Characteristics, Rectifiers, Filter circuits, efficiency, Ripple factor, voltage multiplying circuits, Regulation - Shunt regulators, Series regulators, Use of fixed- and variable-voltage monolithic regulators, Working principle and Block diagram of UPS, Inverter and SMPS.

TUTORIALS: Relevant problems given at the end of chapters in the books.

Recommended Books:
PHYS 214H PHYSICS LABORATORY (90 hrs.) Max. Marks: 15+60 = 75

Note:
(i) Examination time will be 3 hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class and number of experiments performed.
(ii) There will be a 30 minutes written comprehensive test containing short answer questions for the whole class before the actual laboratory examination. This test will have a weightage of 15 marks and will be jointly set by the teachers involved in the examination and will be of general nature.
(iii) Seven to nine experiments are to be performed in third Semester. Experiments performed in third semester can not be repeated in fourth semester.

List of Experiments:
1. To determine Cauchy’s constants and resolving power of a given prism.
2. To find the refractive index of a given liquid using a prism spectrometer.
3. To determine the wavelength of sodium light using Newton’s rings method.
4. To find the resolving power and magnification of a telescope.
5. To find the resolving power and magnification of a diffraction grating.
6. To study hydrogen/Neon gas discharge tube spectrum using diffraction grating.
7. To study temperature dependence of refractive index of organic liquid using Abbe’s refractometer.
8. To study the variation of specific rotation of sugar solution with concentration.
9. To measure power distribution and divergence parameters of He-Ne and Semiconductor Lasers.
10. To study Moire’s fringe patterns and applications to measure small distance and angle.
11. Determination of mechanical equivalent of heat by Calendar and Barne’s constant flow method.
12. To measure the thermal conductivity and thermal diffusivity of a conductor.
13. To determine the value of Stefan’s Constant of radiation.
14. To determine thermal conductivity of a bad conductor disc (i) Lees and Chorlton method using steam heating and thermometers (ii) Advance kit involving constant current source for heating and thermocouples for temperature measurements.
15. Measurement of the electrical and thermal conductivity of copper to determine its Lorentz number.
16. To draw the characteristics of a given triode and to determine the tube parameters.
17. To determine energy band gap of a given semiconductor.
18. Calibration of a Si diode, a thermistor and thermocouple for temperature measurements.
19. To measure low resistance by Kelvin’s double bridge/ Carey Foster’s bridge.
20. To study I-V characteristics of different diodes - Ge, Si, LED and Zener. Use constant current source for Zener.
21. To study voltage regulation and ripple factor for a half-wave and a full-wave rectifier without and with different filters. Use of Zener diode and IC regulators.
22. To study common emitter characteristics of a given transistor and to determine various parameters.
23. To study common base characteristics of a given transistor and to determine various parameters.
24. To measure high resistance by leakage method.
25. To study the induced emf as a function of the velocity of magnet and to study the phenomenon of electromagnetic damping.
26. To study the variation of magnetic field with distance along axis of a circular coil – realization of Helmholtz’s coils.
27. Measurement of thermal relaxation time constant of a serial light bulb
28. To determine charge to mass ratio (e/m) of an electron by helical method using CRT.
29. Verification of laws of probability and radioactivity (mechanical analogue).
30. To find the first ionization potential of mercury.
31. To measure the dielectric constant of an insulator using Leacher Wire and study concepts of impedance matching using standing wave patterns.
32. Study of G.M. Counter characteristics. Measurements of Background radiation and alpha, beta and gamma rays using natural sources.

Compulsory exercises on fabrication etc. utilizing workshop facility Wood/Metal/Electronics (Students will submit the report on these exercises which are equivalent to one experiment).
PHYSICS SYLLABUS FOR B.SC. (HONS. SCHOOL)
FOURTH SEMESTER FOR STUDENTS OF PHYSICS (MAJOR)

PHYS 221H : ELECTROMAGNETIC THEORY (45 hrs.) Max. Marks: 15+60 = 75

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

I Electromagnetic Waves: Maxwell’s equations, wave equation, e.m. waves in a medium with finite $\varepsilon$ and $\mu$. Plane waves, Energy flux due to a plane e.m. wave, Wave-impedance of a medium to e.m. waves, e.m. waves in a conducting medium – skin depth and impedance of a conductor. Reflection and Transmission of e.m. waves at the boundary of two dielectric media - impedance and refractive index, e.m. theory of dispersion.


III Interference: Light vector, coherence, theory of interference. Young’s double slit experiment, Fresnel’s Biprism, displacement of fringes, fringes with white light, Stoke’s law, interference in thin films, non-reflecting films, Newton’s rings and applications, Michelson’s interferometer—principle, theory and applications, Fabry-Perot interferometer and etalon, Interference filters.


TUTORIALS : Relevant Problems on the topics covered in the course.

Recommended Books:
PHYS 222H THERMODYNAMICS (45 hrs.)

Max. Marks: 15+60 = 75

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

I Statistical Basis of Entropy: Definition of entropy, change of entropy of a system, third law of thermodynamics. Additive nature of entropy, law of increase of entropy, reversible and irreversible processes and their examples, work done in a reversible process, Increase of entropy in some natural processes, entropy and disorder.

II Entropy and Carnot’s Engine: Review of terms used in thermodynamics and of Carnot’s Heat Engine, Entropy changes in Carnot’s cycle, Carnot’s theorem, Thermodynamic temperature scale, Third law, ThermoElectric effect and its thermodynamical analysis, change of entropy along a reversible path in P-V diagram, entropy of a perfect gas, equation of state of an ideal gas, Heat death of Universe.

III Maxwell’s Thermodynamic Relations: Perfect differentials in Thermodynamics, Maxwell Relationships, cooling produced by adiabatic expansion, adiabatic compression, adiabatic stretching of wires and thin films, change of internal energy with volume, \( C_p - C_v \), variation of \( C_v \) with volume, Clapeyron’s equation. First and Second-order phase transitions. Thermodynamic equilibrium of a heterogeneous system. Application of phase rule to systems with one or more components.

IV Production of Low Temperature: Joule-Thomson effect and its thermodynamic treatment, Joule-Thomson effect for a Vander Waal’s gas. Production of very low temperatures by adiabatic demagnetization, Measurement of very low temperatures.

V Specific Heat of Gases: Specific Heats of monoatomic and diatomic gases, Energy due to rotation and its variation, quantization of rotational motion, contribution of rotational energy to specific heat, quantization of vibrational motion, contribution of vibrational energy to specific heat, specific heat of diatomic gases.

TUTORIALS: Relevant Problems given at the end of chapters in books 1 and 2.

Recommended Books:
PHYS 223H ELECTRONICS AND NETWORK THEORY-II (45 hrs.)

Max. Marks: 15+60 = 75

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Circuit Theory: Maximum Power Transfer Theorem, Series and parallel connection of mutually coupled coil, Equivalent circuit of transformer, Impedance transformer and power relationship.


Oscillators: Barkhausen criterion of sustained oscillations, LC oscillators - Hartley oscillator, Colpitts oscillator; RC oscillators – Phase-shift and Wein-bridge oscillators; Crystal oscillators.

Digital Electronics: Number systems, BCD code, Arithmetic of signed and unsigned numbers, Logic systems, Circuits for OR, AND, NOT gates, Exclusive OR gate, New IEEE symbols, Boolean laws and theorems, Positive and negative logic, Digital IC's, IC families.

Communication: Electronic communication system, Radio wave propagation, AM, FM – Modulation and detection, Radio transmitter and receiver. TV receiver, Pulse Modulation, Modem.

TUTORIALS: Relevant problems given at the end of chapters in the books.

Books
Note:
(i) Examination time will be 3 hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class, number of experiments performed etc.
(ii) There will be a 30 minutes written comprehensive test containing short answer questions for the whole class before the actual laboratory examination. This test will have a weightage of 15 marks and will be jointly set by the teachers involved in the examination and will be of general nature.
(iii) Seven to nine experiments are to be performed in third Semester. Experiments performed in third semester can not be repeated in fourth semester. The list of the experiments is same as given in PHYS 214H LABORATORY Course.

List of Experiments:
1. To determine Cauchy's constants and resolving power of a given prism.
2. To find the refractive index of a given liquid using a prism spectrometer.
3. To determine the wavelength of sodium light using Newton’s rings method.
4. To find the resolving power and magnification of a telescope.
5. To find the resolving power and magnification of a diffraction grating.
6. To study hydrogen/Neon gas discharge tube spectrum using diffraction grating.
7. To study temperature dependence of refractive index of organic liquid using Abbe’s refractometer.
8. To study the variation of specific rotation of sugar solution with concentration.
9. To measure power distribution and divergence parameters of He-Ne and Semiconductor Lasers.
10. To study Moire’s fringe patterns and applications to measure small distance and angle.
11. Determination of mechanical equivalent of heat by Calendar and Barne's constant flow method.
12. To measure the thermal conductivity and thermal diffusivity of a conductor.
13. To determine the value of Stefan’s Constant of radiation.
14. To determine thermal conductivity of a bad conductor disc (i) Lees and Chorlton method using steam heating and thermometers (ii) Advance kit involving constant current source for heating and thermocouples for temperature measurements.
15. Measurement of the electrical and thermal conductivity of copper to determine its Lorentz number.
16. To draw the characteristics of a given triode and to determine the tube parameters.
17. To determine energy band gap of a given semiconductor.
18. Calibration of a Si diode, a thermistor and thermocouple for temperature measurements.
19. To measure low resistance by Kelvin’s double bridge/ Carey Foster’s bridge.
20. To study I-V characteristics of different diodes - Ge, Si, LED and Zener. Use constant current source for Zener.
21. To study voltage regulation and ripple factor for a half-wave and a full-wave rectifier without and with different filters. Use of Zener diode and IC regulators.
22. To study common emitter characteristics of a given transistor and to determine various parameters.
23. To study common base characteristics of a given transistor and to determine various parameters.
24. To measure high resistance by leakage method.
25. To study the induced emf as a function of the velocity of magnet and to study the phenomenon of electromagnetic damping.
26. To study the variation of magnetic field with distance along axis of a circular coil – realization of Helmholtz’s coils.
27. Measurement of thermal relaxation time constant of a serial light bulb
28. To determine charge to mass ratio (e/m) of an electron by helical method using CRT.
29. Verification of laws of probability and radioactivity (mechanical analogue).
30. To find the first ionization potential of mercury.
31. To measure the dielectric constant of an insulator using Leacher Wire and study concepts of impedance matching using standing wave patterns.
32. Study of G.M. Counter characteristics. Measurements of Background radiation and alpha, beta and gamma rays using natural sources.

Compulsory exercises on fabrication etc. utilizing workshop facility Wood/Metal/Electronics (Students will submit the report on these exercises which are equivalent to one experiment).
PHYSICS SYLLABUS FOR B.SC. (HONS. SCHOOL)
FIFTH SEMESTER FOR STUDENTS OF PHYSICS (MAJOR)

PHYS 311H: MATHEMATICAL PHYSICS (45 hrs.)  Max. Marks: 15+60 = 75

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All questions will carry equal marks, viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.


III. Infinite Series: Fundamental concepts, convergence tests, alternating series, algebra of series, power series, Taylor series.


V. Multiple Integrals: Double and triple integrals, application of multiple integrals, change of variables in integrals, general properties of Jacobians, surface and volume integrals.

VI. Statistics and Probability: Statistical distributions, second moments and standard deviations, definition of probability, fundamental laws of probability, discrete probability distributions, combinations and permutations, continuous distributions – expectation, moments and standard deviation, Binomial, Poisson and Gaussian distributions, applications to experimental measurement.

Tutorials: Relevant problems given in books 1-4.

Recommended Books:
Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

I. Introduction: Introduction, monochromaticity, temporal and spatial coherence, Einstein’s coefficients, momentum transfer, possibility of light amplification, kinetics of optical absorption, shape and width of spectral lines, line broadening mechanism, natural, collision and Doppler broadening.

II. Laser Pumping and Resonators: Resonators, modes of a resonator, number of modes per unit volume, open resonators, confocal resonator (qualitative), quality factor, losses inside the cavity, threshold condition, quantum yield.

III. Dynamics of the Laser Processes: Rate equations for two, three and four level systems, production of a giant pulse – Q switching, giant pulse dynamics, laser amplifiers, mode-locking, hole burning, distributed feedback lasers.


V. Applications: Holography, non-linear optics: harmonic generation, second harmonic generation, phase matching and optical mixing, brief qualitative description of some experiments of fundamental importance.

TUTORIALS: Problems pertaining to the topics covered in the course.

Recommended Books:
PHYS 313H : CONDENSED MATTER PHYSICS (45 hrs.)  Max. Marks: 15+60 = 75

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

I. Solids and Crystal Structure: General definitions of Lattice, basis and primitive cell, Symmetry operations, Bravais lattices in two and three dimensions, Index system for crystal planes, resume of common lattice types (sc, fcc, bcc, hcp, diamond, NaCl, CsCl & ZnS structures), fcc & hcp structures as stacking, Structures of insulators and metals, radius ratio rules and Pauling’s principles.

II. Reciprocal Lattice and X-ray Diffraction: Reciprocal Lattice, Miller indices, Brillouin zone of sc, fcc and bcc lattices, Experimental diffraction methods, Bragg diffraction, scattered wave amplitude: atomic form factor, structure factor of simple structures (sc, fcc, bcc, hcp, diamond, NaCl, CsCl & ZnS), Neutron and electron diffraction methods, Temperature dependence of reflection lines.

III. Crystal Binding: Cohesive energy and bulk modulus in inert gas and ionic crystal, Binding in metallic, covalent and H-bonded crystals (basic ideas only).

IV. Lattice Vibrations: Dynamics of monatomic and diatomic linear chains, optical and acoustic modes, concept of phonons, inelastic scattering of photons and neutrons by phonons, density of states (one & Three dimensions), Einstein and Debye models of heat capacity, thermal expansion.

V. Free Electron Fermi Gas: Review of statistical mechanics of Fermi Gas of non-interacting electrons, heat capacity of electron gas, electrical conductivity, Ohm’s Law, Hall effect, thermal conductivity and Pauli Paramagnetism.

VI. Band Theory: Bloch functions, Kronig-Penney model, Qualitative ideas of bands in metals, semi-metals, semiconductors and insulators, Fermi surface-basic idea with square lattice as an example.

TUTORIALS: Relevant problems on the topics covered in the course.

Recommended Books:
Phys 314h: Nuclear Physics (45 hrs.)

Max. Marks: 15+60 = 75

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

I. Nuclear properties: Constituents of nucleus, non-existence of electrons in nucleus, Nuclear mass and binding energy, features of binding energy versus mass number curve, nuclear radius, angular momentum and parity, qualitative discussion of two-body nuclear forces, nuclear moments, magnetic dipole moment and electric quadrupole moment.

II. Radioactive decays: Modes of decay of radioactive nuclides and decay Laws, chart of nuclides and domain of instabilities, Radioactive dating, constituents of Cosmic rays. Beta decays: $\beta^-$, $\beta^+$ and electron capture decays, allowed and forbidden transitions (selection rules), parity violation in $\beta$-decay. Alpha decay: Stability of heavy nuclei against break up, Geiger-Nuttal law, barrier penetration as applied to alpha decay, reduced widths, deducing nuclear energy levels. Gamma transitions: Excited levels, isomeric levels, gamma transitions, multipole moments, selection rules, transition probabilities, internal conversion (IC), determination of multipolarity from $\gamma\gamma$-correlation and IC measurements.

III. Nuclear reactions: Types of nuclear reactions, reactions cross section, conservation laws, Kinematics of nuclear reaction, Q-value and its physical significance, compound nucleus.

IV. Nuclear Models: Liquid drop model, semi-empirical mass formula, condition of stability, Fermi gas model, evidence for nuclear magic numbers, Shell model, energy level scheme, angular momenta of nuclear ground states.

Tutorials: Relevant problems on the topics covered in the course.

Recommended Books:
PHYS 315H : PHYSICS OF VACUUM AND LOW TEMPERATURE (45 hrs.)

Max. Marks: 15+60 = 75

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.


II. Production of Low Pressures: Pump types, Gaede oil-sealed rotating vane pump, Diffusion pump, sputterion pumps, Gettering, types of getters, Cryogenic pumps.


IV. Methodology of Vacuum systems: Materials for vacuum system, cleaning and sealing of vacuum system, Leak detection and its location.

V. Production and Measurement of Low Temperatures: Adiabatic throttling of gases, liquefaction of H₂ and He, Solidification of He. Liquid He II, Thermodynamics of λ-transition, Adiabatic demagnetization, Temperatures below 0.01K, Low temperature thermometry.

VI. Some Systems at Low Temperatures: Low temperature technique, Use of liquid air and other liquefied gases, Superfluidity in He II, Bose-Einstein Condensation in atomic clouds. LASER cooling and trapping of atoms, Superconductivity.

TUTORIALS: Relevant problems on the topics covered in the course.

Recommended Books:
Note:
(i) Examination time will be 3 hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class and number of experiments performed.
(ii) There will be a 30 minutes written comprehensive test containing short answer questions for the whole class before the actual laboratory examination. This test will have a weightage of 25 marks and will be jointly set by the teachers involved in the examination and will be of general nature.
(iii) Seven to nine experiments are to be performed in fifth Semester. Experiments performed in fifth semester can not be repeated in sixth semester.

List of Experiments:
A review of error propagation, fitting of the curve and basic electronics instruments (oscilloscope, multimeter, voltmeter, ammeter, measurement of resistance, capacitance, inductance etc).

1. Design of a (i) regulated power supply and (ii) constant current supply. Study its load regulation. This is a compulsory exercise for all students.
2. To study the dependence of energy transfer on the mass ratio of the colliding bodies, using air track.
3. To verify the law of conservation of linear momentum in collision with initial momentum zero, using air track.
4. To measure the coupling factor between two pendulums and study its dependence on coupling mass and distance of coupling threads from axes of oscillation.
5. To study the dependence of frequency of normal modes and their difference in a coupled oscillator on coupling mass.
6. To study the series and parallel L.C.R. circuit and find its Q factor for different resistances.
7. To study the characteristics of given voltage doubler and tripler.
8. To study the clipping and clamping circuits.
9. To study the frequency response of given RC coupled transistor amplifier and determine its band width.
10. To determine the distributed capacity of given inductance coil.
11. To determine the given capacitance using flashing and quenching of a neon bulb.
12. To determine the operating plateau and dead time of a given G.M. Counter.
13. To study the high energy interactions in nuclear emulsion – Energy of star.
14. To determine the Hall coefficient and mobility of given semiconductors.
15. To study transmission line modeled as LC ladder and find out its propagation constant.
16. To measure magnetic volume susceptibility of liquid - FeCl₂/MnSO₄ solution by Quincke’s method.
17. To find conductivity of given semiconductor crystal using four probe method.
18. To measure dielectric constant of a non-polar liquid and its applications.
19. To study the characteristics of silicon and GaAs solar cells.
20. To study the characteristics of LED and photodiode.
21. To study the variation of the magneto-resistance of a sample with the applied magnetic field.
22. To design astable multivibrator using transistors.
23. To study the amplitude modulation.
24. Study of excitations of a given atom by Franck Hertz set up.
25. To determine charge to mass ratio (e/m) of an electron by Thomson method.
26. To measure the Numerical Aperture of Optical Fiber and study Propagation Loss and Bending Losses.
27. To determine the velocity of ultrasonic waves in liquids by diffraction of light method.
28. Refractive index of air using Jamin’s Interferometer.
29. To study the Fresnel’s bi-prism and application.
30. To study the Michelson interferometer and its application.
31. To study the intensity profile of the diffraction pattern of single slit and verify the uncertainty principle by using LASER.
32. Random sampling of an alternating current source, simulation and probabilistic observations.
33. Determination of dissociation limit of iodine molecule by constant deviation spectrograph
34. Study of Arc emission spectrum of given samples (Fe and Cu).
35. To determine the heat capacity of given materials.
36. To determine electronic charge (e) by Millikan’s oil drop method.
PHYSICS SYLLABUS FOR B.SC. (HONS. SCHOOL)
SIXTH SEMESTER FOR STUDENTS OF PHYSICS (MAJOR)

PHYS 321H: QUANTUM MECHANICS (45 hrs.)     Max. Marks: 15+60 = 75

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All questions will carry equal marks, viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Review of old quantum mechanics

I. Wave packets and the uncertainty principle: Uncertainty of position and momentum – exact statement and proof, energy-time uncertainty, Gaussian wave packet and its spread with time, general solution for time dependence of \( \psi \), causality.

II. The Schrödinger Equation: Interaction among particles, analogy between optics and mechanics, superposition principle, probability current, motion of wave packets, Ehrenfest's theorem.

III. Problems in one dimension: Potential step, potential barrier, rectangular potential well, degeneracy, linear independence, Sturm's theorem, bound states, orthogonality, linear harmonic oscillator, oscillator wave function, parity.

IV. Operators and Eigenfunctions: Linear operators, operator formalism in quantum mechanics, orthogonal systems, expansion in eigenfunctions, Hermitian operators, commutation rule and uncertainty principle, equation of motion, parity operator.

V. Spherically Symmetric System: Series solutions for Hermite, Lagguerre and associated Lagguerre equations, Schrödinger equation for spherically symmetric potentials, spherical harmonics, degeneracy, angular momentum, eigenvalues of \( L_z \) and \( L_2 \), three-dimensional harmonic oscillator, Hydrogen atom.

Tutorials: Relevant problems given in following books.

Recommended Books:
2. Introduction to Quantum Mechanics, D.J. Griffiths (Pearson), 2005.
Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.


II. Alkali-like Spectra: General features, doublet structure, Larmor’s theorem and magnetic levels, elementary theory of weak and strong magnetic fields, Zeeman effect in doublet spectra: anomalous Zeeman effect and the anomalous g-value.

III. Pauli’s principle and shell structure: Systems with several electrons and spin functions.

IV. Complex Spectra: LS-Coupling scheme, normal triplets, basic assumptions of the theory, identification of terms, selection rules, jj- coupling (Qualitative).

V. Infrared and Raman Spectra: Rigid rotator, energy levels, spectrum (no derivation of selection rules), Harmonic oscillator: energy levels, eigenfunctions, spectrum, comparison with observed spectrum, Raman effect, Quantum theory of Raman effect, Rotational and Vibrational Raman spectrum. Anharmonic oscillator: energy levels, Infrared and Raman Spectrum, Vibrational frequency and force constants. Non-rigid rotator: energy levels, spectrum, Vibrating-rotator energy levels, Infrared and Raman spectrum (no derivation of Dunham coefficients), Symmetry properties of rotational levels, influence of nuclear spin.


TUTORIALS: Problems pertaining to the topics covered in the course.

Recommended Books:
Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.


II. Crystal Imperfections: Point, line, surface and volume imperfections, dislocations and their geometry, Disorder in polymers and non-crystalline materials.

III. Phase Diagrams: Phase rule, Single component systems, Binary phase diagrams, Lever rule, phases in polymers, non-crystalline and crystalline phases. Non-equilibrium in phase diagrams, Cu-Zn system, Fe- C alloys, Ceramic Systems, Other applications of phase diagrams.

IV. Phase Transformations: Time scale for phase changes, Nucleation kinetics, Growth of nuclei and solidification of alloys, Transformations in steel, Precipitation processes, Glass Transition; Recovery, recrystallization and grain growth.


VI. Fracture: Ductile fracture, Brittle fracture, Fracture toughness, Ductile-brittle transition, Protection against fracture, Fatigue fracture.

TUTORIALS: Relevant problems on the topics covered in the course.

Recommended Books:
PHYS 324H : PARTICLE PHYSICS (45 hrs.)          Max. Marks: 15+60 = 75

Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

I. Interaction of radiation and charged particles with matter: Energy loss of electrons and positrons, Positron annihilation in condensed media, Stopping power and range of heavier charged particles, derivation of Bethe-Bloch formula, interaction of gamma rays with matter.

II. Nuclear radiation detection: Gas-filled detectors, proportional and Geiger-Muller counters, Scintillation detectors, solid-state detectors, Cherenkov effect, calorimeter-electromagnetic and hadron, specialized detectors, solid state nuclear track detectors, bubble chambers, nuclear emulsions.

III. Accelerators: Accelerators, linear accelerators, cyclic accelerators, ion sources, focusing, stability, electron synchrotron, colliding beam machines, particle beams for fixed target experiments, CERN Super Proton Synchrotron (SPS) and Fermilab Tevatron.

IV. Elementary Particles: Historical introduction, fermions and bosons, particles and antiparticles, Classification of particles, types of interactions, electromagnetic, weak, strong interactions, gravitational interactions, Quantum numbers and conservation laws, isospin, charge conjugation, Yukawa theory, Introduction to quarks and qualitative discussion of the quark model, high energy physics units.

V. Particle Properties and their reactions: Properties and life time of muon, pions: Determination of mass, spin and parity. Lifetime of neutral pion and isotopic spin. Strange particles: V particles, charged K-mesons, mass and life time for charged K-mesons. Observations of different strange particles ($\Lambda^0, \Sigma^0, \Sigma^\pm, \Xi^0, \Xi^\pm, \Omega$), strange particle production and decay. Strangeness and Hypercharge.

TUTORIALS: Relevant problems on the topics covered in the course.

Recommended Books:
Note:
(i) The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all including compulsory question. All Questions will carry equal marks viz. 12.
(ii) The question paper is expected to contain problems with a weightage of 25 to 40%.
(iii) The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

I. Hyperfine Interactions: Electrostatic hyperfine interaction, Monopole and quadrupole interactions.
Magnetic hyperfine interaction, Origin of magnetic hyperfine flux density, Combined electric and magnetic hyperfine interactions.

II. Mossbauer Spectroscopy: Spectral line-shape of $\gamma$-rays, Recoilless emission of $\gamma$-rays, Resonance fluorescence and nuclear gamma resonance, Mossbauer spectrum – Isomer shift, Quadrupole splitting, Magnetic hyperfine structure, Combined electric and magnetic hyperfine splitting, line intensity, line width. Mossbauer spectrometer, Applications.


IV. Nuclear Magnetic Resonance: Quantum mechanical description of NMR; The Bloch equation and its solutions – free precession; steady state in weak r.f. field, in-phase and out-of-phase susceptibilities, power absorption; Saturation effects at high radio-frequency power; intense r.f. pulses. Fourier Transform NMR. The NMR spectrum – Chemical shift, spin-spin coupling. NMR spectrometer. Applications.

V. Other Resonance Phenomena: Nuclear quadrupole resonance and its applications, Ferromagnetic resonance – shape effects and applications.

TUTORIALS: Relevant problems on the topics covered in the course.

Recommended Books:
Note:
(i) Examination time will be 3 hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class and number of experiments performed.
(ii) There will be a 30 minutes written comprehensive test containing short answer questions for the whole class before the actual laboratory examination. This test will have a weightage of 25 marks and will be jointly set by the teachers involved in the examination and will be of general nature.
(iii) Seven to nine experiments are to be performed in sixth Semester. Experiments performed in fifth semester can not be repeated in sixth semester.

List of Experiments:
A review of error propagation, fitting of the curve and basic electronics instruments (osciloscope, multimeter, voltemter,ameter, measurement of resistance, capacitance, inductance etc).

1. Design of a (i) regulated power supply and (ii) constant current supply. Study its load regulation. This is a compulsory exercise for all students.
2. To study the dependence of energy transfer on the mass ratio of the colliding bodies, using air track.
3. To verify the law of conservation of linear momentum in collision with initial momentum zero, using air track.
4. To measure the coupling factor between two pendulums and study its dependence on coupling mass and distance of coupling threads from axes of oscillation.
5. To study the dependence of frequency of normal modes and their difference in a coupled oscillator on coupling mass.
6. To study the series and parallel L.C.R. circuit and find its Q factor for different resistances.
7. To study the characteristics of given voltage doubler and tripler.
8. To study the clipping and clamping circuits.
9. To study the frequency response of given RC coupled transistor amplifier and determine its band width.
10. To determine the distributed capacity of given inductance coil.
11. To determine the given capacitance using flashing and quenching of a neon bulb.
12. To determine the operating plateau and dead time of a given G.M. Counter.
13. To study the high energy interactions in nuclear emulsion – Energy of star.
14. To determine the Hall coefficient and mobility of given semiconductors.
15. To study transmission line modeled as LC ladder and find out its propagation constant.
16. To measure magnetic volume susceptibility of liquid - FeCl$_2$/MnSo$_4$ solution by Quincke’s method.
17. To find conductivity of given semiconductor crystal using four probe method.
18. To measure dielectric constant of a non-polar liquid and its applications.
19. To study the characteristics of silicon and GaAs solar cells.
20. To study the characteristics of LED and photodiode.
21. To study the variation of the magneto-resistance of a sample with the applied magnetic field.
22. To design astable multivibrator using transistors.
23. To study the amplitude modulation.
24. Study of excitations of a given atom by Franck Hertz set up.
25. To determine charge to mass ratio (e/m) of an electron by Thomson method.
26. To measure the Numerical Aperture of Optical Fiber and study Propagation Loss and Bending Losses.
27. To determine the velocity of ultrasonic waves in liquids by diffraction of light method.
28. Refractive index of air using Jamin’s Interferometer.
29. To study the Fresnel's bi-prism and application.
30. To study the Michelson interferometer and its application.
31. To study the intensity profile of the diffraction pattern of single slit and verify the uncertainty principle by using LASER.
32. Random sampling of an alternating current source, simulation and probabilistic observations.
33. Determination of dissociation limit of iodine molecule by constant deviation spectrograph
34. Study of Arc emission spectrum of given samples (Fe and Cu).
35. To determine the heat capacity of given materials.
36. To determine electronic charge (e) by Millikan’s oil drop method.
Objective: This course has been framed to teach the students the elements of Newtonian mechanics, simple damped and forced oscillations and propagation of waves in physical media.

Note:
1. The question paper for the final examination will consist of three sections. Sections A and B of the paper will have three questions each from the corresponding sections of the syllabi and section C will have one compulsory question covering the whole syllabus. There will be no choice in the compulsory question.
   The candidate will attempt five questions in all, selecting two questions each from sections A and B and compulsory question from section C. All Questions will carry equal marks viz. 12.
2. The question paper is expected to contain problems with a weightage of 25 to 40%.
3. The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

SECTION A: MECHANICS

Vector Algebra and Co-ordinate Systems: Review of vector operations, rectangular Cartesian coordinate system, spherical polar coordinates, two dimensional displacement, velocity and acceleration. (Book I)

Particle Dynamics: Dynamical concepts- mechanics of a system of particles. (4.2,4.3 of Book I)

Conservation laws and Properties of space and time: Conservation of linear and angular momenta, homogeneity of flow of time. (Book 1)

Elastic and Inelastic Scattering: Types of scattering and conservation laws, Laboratory and centre of mass systems, collision of particles which stick together, General elastic collision of particles of different mass, Crosssection of elastic scattering, Rutherford scattering. (Book 1).

Frames of Reference and Relativity: Definitions, inertial reference frames, coordinate transformations within reference frame, Newtonian mechanics and principle of relativity, Galilean transformations, origin and significance of the special theory of relativity, search of a universal frame of reference, postulates of the special theory of relativity, Lorentz transformations and their kinematical consequences, intervals, space-like and time-like, variation of mass with velocity, mass energy equivalence, Particles with zero rest mass. (Book 1).

SECTION B: Waves

Simple Harmonic Free Vibrations: Simple harmonic motion, energy of a SHO, Compound pendulum, Electrical Oscillations, Transverse Vibrations of a mass on a string, composition of two perpendicular SHMs of same period and of periods in ratio 1:2, Anharmonic Oscillations.(Book 2)

Damped Simple Harmonic Vibrations: Decay of free Vibrations due to damping, types of damping, Determination of damping coefficients – Logarithmic decrement, relaxation time and Q-factor. Electromagnetic damping. (Book 2)
Forced Vibrations and Resonance: A forced oscillator, Transient and Steady State Oscillations, velocity versus driving force frequency, Resonance, power supplied to forced oscillator by the driving force. Q-factor of a forced oscillator, Electrical, nuclear and nuclear-magnetic resonances. (Book 2)

Waves in Physical Media: Wave motion in one dimension, Transverse and longitudinal waves, progressive harmonic waves and their energy, Transverse waves on a string, longitudinal waves on a rod, characteristic impedance of a string, waves in an absorbing medium, spherical waves. (Book 2)

Recommended Books:

PHYS 112S PHYSICS LABORATORY (45 hrs.) Max. Marks: 5 + 20 = 25

Objective: The aim of the laboratory exercises is to train the students in handling the equipments, verifying some laws they study in theory and making them confident to perform precise measurements.

Note:
1. Examination time will be 3 hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class, number of experiments performed etc.
2. Eight to ten experiments are to be performed in each Semester. Experiments performed in odd semester can not be repeated in even semester. Exercises (i) and (ii) are compulsory for all students in first semester.

List of Experiments
(i) Analysis of experimental data by Fitting of given data to a straight line.
(ii) Calculation of probable error. Use of vernier calipers, screw gauge and spherometer and other measuring instruments, Barometer.
1. Determination of ‘g’ by bar pendulum.
2. Determination of ‘g’ by Kater's pendulum.
4. To determine Young's modulus of material of a bar by bending method.
5. Determination of modulus of rigidity by torsional pendulum.
6. Determination of coefficient of viscosity of a given liquid by Stoke’s method.
7. Determination of coefficient of linear expansion
8. Determination of thermal conductivity of a bad conductor by Lee’s Disc method
9. Determination of Stefan's constant.
10. Determination of focal length of convex mirror by beam compass method.
11. Determination of magnifying power of a telescope by slit method.
12. Determination of resolving power of a telescope.
13. Determination of frequency of A.C. mains by using electrical vibrator.
15. To determine the wave-length of laser light using a plane diffraction grating.
17. Determination of specific rotation of sugar using a Polarimeter.
18. Study of one dimensional collisions.
19. Determination of height (of inaccessible structure) using sextant.
PHYSICS SYLLABUS FOR B.Sc. (HONS. SCHOOL) SECOND SEMESTER
SUBSIDIARY FOR STUDENTS OF CHEMISTRY, COMPUTER SCIENCE, GEOLOGY
AND MATHEMATICS

PHYS 121S : OPTICS AND THERMAL PHYSICS (50 hrs.)  Max. Marks: 15+60 = 75

Objective: The syllabus has been framed keeping in mind the needs of the students of basic medical sciences in their later training.

Note:
1 The question paper for the final examination will consist of three sections. Sections A and B of the paper will have three questions each from the corresponding sections of the syllabi and section C will have one compulsory question covering the whole syllabus. There will be no choice in the compulsory question.
2 The question paper is expected to contain problems with a weightage of 25 to 40%.
3 The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Section A: Optics
Interference : Young's experiment, coherent sources, phase and path differences, Theory of interference fringes, Fresnel's biprism, sheet thickness determination, interference in thin films due to reflected and transmitted lights, Maxima and minima in intensities, Colours of thin films, Newton's rings and its various aspects, Non-reflecting films. (Book 1).
Polarization : Introduction, Polarization by reflection, Brewester's law, Polarization by refraction, Malus's law, Double refraction, Nicol Prism and its use, elliptically and Circularly polarized light, quarter and half-wave plates, production and detection of plane, circularly and elliptically polarized light, optical activity, specific rotation, Half-shade polarimeter. (Book 1).
Spectrum: Mercury and sodium lamps, spectra and their classifications, infrared and ultra-violet spectra. Zeeman effect, Stark effect, Raman effect. (Book 1).
Laser and Holography: Brief features of laser, holography and fibre optics. (Book 1).

Section B: Thermal Physics
Statistical Physics: Scope of statistical physics, micro and macrostates, thermodynamic probability distribution of n particles in two compartments, deviation from the state of maximum probability; equilibrium state of dynamic system, distribution of distinguishable particles in compartments and cells, phase space and its division into cells, Boltzmann statistics for ideal gas, Bose-Einstein statistics and its application to black body radiation, Fermi-Dirac statistics and its application to electron gas, comparison of the three statistics. (Book2).
Thermodynamics: Statistical basis of entropy, Change of entropy of a system, third law of thermodynamics, additive nature of entropy, law of increase of entropy, reversible and irreversible processes, increase of entropy in some natural processes, entropy of a perfect gas.
Maxwell's relationships and their applications, cooling produced by adiabatic expansion, adiabatic compression, Cp-Cv, Clapeyron equation, Joule-Thomson effect and its thermodynamic treatment for Van der Waal's gas and Joule-Thomson cooling, Liquefication of helium. (Book 2)

**Recommended Books:**

**PHYS 122S PHYSICS LABORATORY (45 hrs.) Max. Marks: 5 + 20 = 25**

**Objective:** The aim of the laboratory exercises is to train the students in handling the equipments, verifying some laws they study in theory and making them confident to perform precise measurements.

**Note:**
1. Examination time will be 3 hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class, number of experiments performed etc.
2. Eight to ten experiments are to be performed in each Semester. Experiments performed in odd semester can not be repeated in even semester. Exercises (i) and (ii) are compulsory for all students in first semester.

**List of Experiments**
1. Analysis of experimental data by Fitting of given data to a straight line.
2. Calculation of probable error. Use of vernier calipers, screw gauge and spherometer and other measuring instruments, Barometer.
3. Determination of ‘g’ by bar pendulum.
4. Determination of ‘g’ by Kater's pendulum.
5. Study of rotational motion using flywheel.
6. To determine Young's modulus of material of a bar by bending method.
7. Determination of modulus of rigidity by torsional pendulum.
8. Determination of coefficient of viscosity of a given liquid by Stoke’s method.
9. Determination of coefficient of linear expansion
10. Determination of thermal conductivity of a bad conductor by Lee’s Disc method
11. Determination of Stefan's constant.
12. Determination of focal length of convex mirror by beam compass method.
15. Determination of frequency of A.C. mains by using electrical vibrator.
17. To determine the wave-length of laser light using a plane diffraction grating.
18. Determination of wave-length of sodium light by Newton's rings method.
19. Determination of specific rotation of sugar using a Polarimeter.
20. Study of one dimensional collision.
PHYSICS SYLLABUS FOR B.Sc. (H.S.) I SEMESTER SUBSIDIARY FOR BIOCHEMISTRY, BIOPHYSICS, BIOTECH. AND MICROBIOLOGY

PHYS 113S: ELECTRICITY, MAGNETISM AND ELECTRONICS 50 hrs

Max. Marks: 15+60 = 75

Objective: This course has been designed for the students of basic medical sciences so that after learning the basic features of electricity and magnetism, they get sufficient exposure to the electronics that can enable them to understand the working of electronic equipment used in their fields of specialization.

Note:
1. The question paper for the final examination will consist of three sections. Sections A and B of the paper will have three questions each from the corresponding sections of the syllabi and section C will have one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all, selecting two questions each from sections A and B and compulsory question from section C. All Questions will carry equal marks viz. 12.
2. The question paper is expected to contain problems with a weightage of 25 to 40%.
3. The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

SECTION- A
Vector Analysis: Vectors and Vector properties, Components of Vectors, Unit Vectors, Product of Vectors. (1.7, 1.8, 1.9, 1.10)
Gauss law: Charges & Electric Flux and calculations, Gauss's Law, Electric Potential Energy and Potential Gradient. (22.1, 22.2, 22.3, 22.4, 23.1, 23.2 23.5)
Magnetism: magnetism, magnetic field, Magnetic field lines and flux, motion of charges particle in Magnetic field, Bio-Savart law, Ampere law, Magnetic Materials, Faraday's Law, Maxwell equations (27.1, 27.2, 27.3, 27.4, 28.2, 28.6, 28.7, 28.8, 29.2, 29.7)

SECTION- B
Dielectric: Dielectric and Gauss’s Law in Dielectric (24.4, 24.6)
Electromotive Forces Electromotive force & Circuits, Mutual Inductance, Self Induction and Inductors (25.4, 30.1, 30.2)
Conduction in Semiconductors: Electrons and holes in semiconductor, carrier concentration, donor and acceptor impurities, charge densities, Fermi Level in semiconductors, diffusion, carrier lifetimes, continuity equation (Book 2)
Diode Characteristics: Qualitative theory of p-n junction, p-n diode, band structure of an open circuit diode, current components, qualitative theory of diode currents, V-I Characteristics. (Book 2)
Transistors: Junction Transistors, Transistor current components, transistor as an amplifier, C B and C E configuration (Book 2)
Applications: Half Wave rectifier, ripple factor, full wave rectifier, filters, photoconductivity, Photodiodes (Book 2)
Recommended Books:
2. Fundamentals of Physics, Resnick & Hlleday, 8th Edition (Wiley)

PHYS 114 S PHYSICS LABORATORY (45 hrs.)  Max. Marks: 5 + 20 = 25

Objective: The exercises included in this laboratory course are aimed at training the students to handle different type of equipment for verification of some of the laws studied in theory and for carrying out precise measurements so that they develop confidence to use later the sophisticated instruments in their respective fields.

Note:
1. Examination time will be 3 hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class, number of experiments performed etc.
2. Eight to ten experiments are to be performed in each Semester. Experiments performed in odd semester can not be repeated in even semester. Exercises (i) and (ii) are compulsory for all students in first semester.

List of experiments
(i) Analysis of experimental data by Fitting of given data to a straight line.
(ii) Calculation of probable error.
(iii) Use of vernier calipers, screw gauge and spherometer and other measuring instruments, Barometer.
1. Determination of wavelength of laser light by a plane diffraction grating.
3. Determination of specific rotation of sugar by Polarimeter.
4. Determination of refractive index of prism for different wave lengths using spectrometer.
5. Self-inductance by Anderson's bridge.
6. Capacitance by de Sauty method.
7. Verification of laws of electromagnetic induction.
8. Verification of Rutherford- Soddy nuclear decay formula - mechanical analogue.
9. To find half-life period of a given radio-active substance using GM counter/ Characteristics of GM Counter
10. Study of C.R.O. as display and measuring device, Study of Sine-wave, square wave signals (half wave and full wave rectification)
13. Determination of Stefan's constant.
15. Study of one dimensional Collision.
17. Determination of Eg in Si and Ge.
18. Study of Ge, Si, LED, diode characteristics.
19. To study the variation of the resistance of filament of bulb with its temperature.
20. Study of common base transistor characteristics.
21. Study of common emitter transistor characteristics
PHYSICS SYLLABUS FOR B.Sc. (HONS. SCHOOL) SECOND SEMESTER
SUBSIDIARY FOR STUDENTS OF BIOCHEMISTRY, BIOPHYSICS, BIOTECHNOLOGY AND MICROBIOLOGY

PHYS 123S : OPTICS AND MODERN PHYSICS (50hrs)  Max. Marks: 15+60 = 75

Objective: This course has been framed keeping in mind the requirements of the students with respect to the concepts of physical optics and quantum mechanics as used in different branches of basic medical sciences.

Note:
1. The question paper for the final examination will consist of three sections. Sections A and B of the paper will have three questions each from the corresponding sections of the syllabi and section C will have one compulsory question covering the whole syllabus. There will be no choice in the compulsory question.
   The candidate will attempt five questions in all, selecting two questions each from sections A and B and compulsory question from section C. All Questions will carry equal marks viz. 12.
2. The question paper is expected to contain problems with a weightage of 25 to 40%.
3. The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

SECTION A: Optics

Interference: Young’s experiment, coherent sources, phase and path differences, Theory of interference fringes, Fresnel's biprism, sheet thickness determination, interference in thin films due to reflected and transmitted lights, Maxima and minima in intensities, Colours of thin films, Newton's rings and its various aspects. (Book 1)


Polarization: Introduction, Polarization by reflection and refraction, Brewester's law, Malus's law, Double refraction, Nicol Prism and its use, elliptically and circularly polarized light, quarter and half-wave plates, production and detection of plane, circularly and elliptically polarized light, optical activity, specific rotation, Half-shade polarimeter. (Book 1).

Laser and Holography: Brief features of laser, holography and fibre optics. (Book 1).

SECTION B: MODERN PHYSICS

Particle Properties of Waves: Quantum theory of light, X-ray diffraction, Compton effect, pair production, Photons and gravity, black holes. (Book2).
Wave Properties of Particles: de Broglie waves, waves of probability, the wave equation, phase and group velocities, particle diffraction, electron microscope, uncertainty principle. (Book2).

Quantum Mechanics: Wave function and wave equation, Schrodinger equation -time-dependent and steady state forms, expectation value. Particle in a box, Schrodinger’s equation for hydrogen atom, separation of variables, quantum numbers. (Book 2).


Recommended Books:

PHYS 124 S PHYSICS LABORATORY (45 hrs.) Max. Marks: 5 + 20 = 25

Objective: The exercises included in this laboratory course are aimed at training the students to handle different type of equipment for verification of some of the laws studied in theory and for carrying out precise measurements so that they develop confidence to use later the sophisticated instruments in their respective fields.

Note:
1. Examination time will be 3 hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class, number of experiments performed etc.
2. Eight to ten experiments are to be performed in each Semester. Experiments performed in odd semester can not be repeated in even semester. Exercises (i) and (ii) are compulsory for all students in first semester.

List of experiments
(i) Analysis of experimental data by Fitting of given data to a straight line.
(ii) Calculation of probable error.
(iii) Use of vernier calipers, screw gauge and spherometer and other measuring instruments, Barometer.
1. Determination of wavelength of laser light by a plane diffraction grating.
3. Determination of specific rotation of sugar by Polarimeter.
4. Determination of refractive index of prism for different wave lengths using spectrometer.
5. Self-inductance by Anderson's bridge.
6. Capacitance by de Sauty method.
7. Verification of laws of electromagnetic induction.
8. Verification of Rutherford- Soddy nuclear decay formula - mechanical analogue.
9. To find half-life period of a given radio-active substance using GM counter/ Charterctisitcs of GM Counter
10. Study of C.R.O. as display and measuring device, Study of Sine-wave, square wave signals ( half wave and full wave rectification)
13. Determination of Stefan's constant.
15. Study of one dimensional Collision.
17. Determination of $E_g$ in Si and Ge.
18. Study of Ge, Si, LED, diode characteristics.
19. To study the variation of the resistance of filament of bulb with its temperature.
20. Study of common base transistor characteristics.
21. Study of common emitter transistor characteristics.
22. Determination of $'e'$ or $(e/m)$ of an electron.
23. Study of Solar-Cell characteristics
24. Determination of Planck’s constant using photocell.
25. Determination of velocity of ultrasonic waves in a given liquid
26. Study of vacuum triode characteristics.

PHYSICS SYLLABUS FOR B.Sc. (HONS. SCHOOL) THIRD SEMESTER
SUBSIDIARY FOR STUDENTS OF CHEMISTRY, COMPUTER SCIENCE, GEOLOGY AND MATHEMATICS

PHYS 211S: ELECTRICITY, MAGNETISM AND ELECTRONICS (50 Hrs)

Max. Marks: 15+60 = 75

Note:
1. The question paper for the final examination will consist of three sections. Sections A and B of the paper will have three questions each from the corresponding sections of the syllabi and section C will have one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all, selecting two questions each from sections A and B and compulsory question from section C. All Questions will carry equal marks viz. 12
2. The question paper is expected to contain problems with a weightage of 25 to 40%.
3. The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Sections- A
I. Vector Analysis : Review of vector algebra, vector differentiation, vector integration, Gauss’s divergence and Stoke’s theorems and their physical significance.
II. Electrostatics : Coulomb’s law, superposition principle, field concept, scalar potential, Energy considerations, relation between field and potential, use of Gauss’s law to calculate electric field, electric field due to a uniform line charge, surface charge, spherical shell of charge, the electric dipole.
III. Dielectrics : The polarization density, polarization charge density, \( \mathbf{D} = \varepsilon \mathbf{E} + \mathbf{P} \)
IV. Current Electricity: Current as moving charge, The Biot-Savart law, some properties of \( \mathbf{B} \), Ampere’s law, the magnetic dipole, the solenoid, magnetic vector and scalar potential, charged particle in magnetic field, charged particle in electric and magnetic fields, Faraday’s law of electromagnetic induction, different mechanisms for change of flux, motional emf, mutual inductance, self inductance.
V. Magnetic field in material media: Types of magnetic substances, magnetization, \( B = \int_0^\infty (M + H) \), Boundary conditions on \( B \) and \( H \), Hysteresis curve.

VI. Maxwell's Equations: Displacement current, Maxwell's equations, Poynting vector.

VII. Some Applications: Electrostatic deflection in a cathode ray tube, Cathode ray oscilloscope, G M Counter.

Sections - B

VIII. Conduction in semiconductors: Electrons and holes in an semiconductor, carrier concentration, donor and acceptor impurities, charge densities, Fermi level in semiconductors, diffusion, carrier lifetimes, continuity equation.

IX. Diode characteristics: qualitative theory of p-n junction, p-n diode, band structure of an open circuit diode, current components, quantitative theory of diode currents, V-I characteristics, transition capacitance, diffusion capacitance.

X. Transistor: Junction transistor, transistor current components, transistor as an amplifier, C B and C E configurations

XI. Low frequency transistor model: The port device and hybrid model, transistor hybrid model, transistor as amplifier using h- parameters, comparison of transistor amplifier configurations.

XII. Applications: Half wave rectifier, ripple factor, full wave rectifier, inductor and capacitor filters, regulated power supply, oscillators (introduction only), photoconductivity, photodiode.

Recommended Books:

PHYS 212S: PHYSICS LABORATORY Max. Marks: 5 + 20 = 25

Note:
1. Examination time will be 3½ hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class, number of experiments performed etc.
2. Eight to ten experiments are to be performed in each Semester. Experiments performed in odd semester can not be repeated in even semester.

List of experiments:
1. Verification of maximum power theorem.
2. Self-inductance by Anderson's bridge.
3. Capacitance of air capacitor and dielectric capacitor by de Sauty method.
4. To calibrate the wire of Carey Foster bridge and hence determine the resistance of two turns of a tangent galvanometer.
5. To study the concentration dependence of the resistance electrolyte
6. To study dependence of magnetic field in a solenoid on various parameters and hence to evaluate \( \mu_0 \).
7. Study of common base transistor characteristics.
8. Study of common emitter transistor characteristics
9. To study the variation of the resistance of filament of bulb with its temperature
10. Determination of high resistance by substitution method.
11. Comparison of e.m.f. of two cells by Lumsden’s method.
12. Study of C.R.O. as display and measuring device, Study of Sine-wave, square wave signals (half wave and full wave rectification)
14. Study of B-H curve of various materials using CRO.
15. Verification of Rutherford- Soddy nuclear decay formula - mechanical analogue.
16. To find half-life period of a given radio-active substance using GM counter
17. Determination of Planck’s constant using photocell.
18. Study of Solar-Cell characteristics
19. Determination of ionization potential of mercury.
20. Verification of laws of electromagnetic induction.
21. To determine ECE of hydrogen
22. Determination of $E_g$ in Si and Ge.
23. Determination of charge on an electron.
24. Study of Ge, Si, LED diode characteristics.
25. Study of vacuum triode characteristics.
26. Determination of velocity of ultrasonic waves in a given liquid

PHYSICS SYLLABUS FOR B.Sc. (HONS. SCHOOL) FOURTH SEMESTER SUBSIDIARY FOR STUDENTS OF CHEMISTRY, COMPUTER SCIENCE, GEOLOGY AND MATHEMATICS

PHYS 221S: MODERN PHYSICS (50 Hrs) Max. Marks: 15+60 = 75

Note:
1 The question paper for the final examination will consist of three sections. Sections A and B of the paper will have three questions each from the corresponding sections of the syllabi and section C will have one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt five questions in all, selecting two questions each from sections A and B and compulsory question from section C. All Questions will carry equal marks viz. 12.
2 The question paper is expected to contain problems with a weightage of 25 to 40%.
3 The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Section A

I. Particle Properties of Waves : Quantum theory of light, X-rays and their diffraction, Compton effect, pair production, photons and gravity, black holes.
II. Wave Properties of Particles : de Broglie waves, waves of probability, the wave equation, phase and group velocities, particle diffraction, uncertainty principle and its applications.
III. Quantum Mechanics: Difference between classical and quantum mechanics, wave function and wave equations. Schrodinger equation, time dependent and steady state forms, Expectation values, particle in a box, reflection and transmission by a barrier, tunnel effect, harmonic oscillator.
Section B


VI. The Atomic Nucleus: Do nuclei contain electrons? The neutron, stable nuclei, nuclear sizes and shapes, binding energy, liquid drop model, shell model, meson theory of nuclear forces.

Radioactivity: Radioactive decay, Half-life, radioactive dating, radioactive series, alpha decay and its theory, beta decay, gamma-decay, radiation hazards and radiation units.

VII. Nuclear Reactions: Reaction cross-section, neutron thermalization, nuclear reactions, c.m. system, nuclear fission, nuclear reactors, breeder reactors, nuclear fusion in stars, fusion reactors.

VIII. Elementary Particles: Interaction of charged particles, gamma ray absorption, particle detection, leptons, hadrons, elementary particle quantum numbers, isospin, symmetries and conservation principles, Quarks, fundamental interactions.

Recommended Books:

PHYS 222S: PHYSICS LABORATORY

Max. Marks: 5+20 = 25

Note:
1. Examination time will be 3½ hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class, number of experiments performed etc.
2. Eight to ten experiments are to be performed in each Semester. Experiments performed in odd semester can not be repeated in even semester.

List of experiments:
1. Verification of maximum power theorem.
2. Self-inductance by Anderson's bridge.
3. Capacitance of air capacitor and dielectric capacitor by de Sauty method.
4. To calibrate the wire of Carey Foster bridge and hence determine the resistance of two turns of a tangent galvanometer.
5. To study the concentration dependence of the resistance electrolyte.
6. To study dependence of magnetic field in a solenoid on various parameters and hence to evaluate $\mu_0$.
7. Study of common base transistor characteristics.
8. Study of common emitter transistor characteristics.
9. To study the variation of the resistance of filament of bulb with its temperature.
10. Determination of high resistance by substitution method.
11. Comparison of e.m.f. of two cells by Lumsden’s method.
12. Study of C.R.O. as display and measuring device, Study of Sine-wave, square wave signals (half wave and full wave rectification).
14. Study of B-H curve of various materials using CRO.
15. Verification of Rutherford- Soddy nuclear decay formula - mechanical analogue.
16. To find half-life period of a given radio-active substance using GM counter.
17. Determination of Planck’s constant using photocell.
19. Determination of ionization potential of mercury.
20. Verification of laws of electromagnetic induction.
21. To determine ECE of hydrogen
22. Determination of $E_g$ in Si and Ge.
23. Determination of charge on an electron.
24. Study of Ge, Si, LED diode characteristics.
25. Study of vacuum triode characteristics.
26. Determination of velocity of ultrasonic waves in a given liquid

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