FACULTY OF SCIENCE

SYLLABI FOR
B.Sc. (HONOURS SCHOOL) PHYSICS & ELECTRONICS

1st TO 6th SEMESTER EXAMINATIONS

2013 – 2014 Session onwards
Syllabi applicable for admissions in 2013

--:O:--
OUTLINES OF TESTS, SYLLABI AND COURSES OF PHYSICS and ELECTRONICS FOR B. Sc. (HONS SCHOOL) IN PHYSICS AND ELECTRONICS

FIRST AND SECOND SEMESTER EXAMINATION

<table>
<thead>
<tr>
<th>Major</th>
<th>MARKS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYE 111 Mechanics</td>
<td>75</td>
<td>3</td>
</tr>
<tr>
<td>PHYE 112 Electricity and Magnetism I</td>
<td>75</td>
<td>3</td>
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<tr>
<td>PHYE 113 Laboratory</td>
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B.Sc. (H. S.) SECOND SEMESTER

<table>
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<tr>
<th>Major</th>
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<th>CREDITS</th>
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<tr>
<td>PHYE 121 Special theory of relativity</td>
<td>75</td>
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<tr>
<td>PHYE 122 Electricity and Magnetism II</td>
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<tr>
<td>PHYE 123 Laboratory</td>
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Note: Internal assessment and end semester examination will be of 20% and 80%, respectively, of the total marks.

THIRD AND FOURTH SEMESTER EXAMINATION

<table>
<thead>
<tr>
<th>Major</th>
<th>MARKS</th>
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<tbody>
<tr>
<td>PHYE 211 Vibrations and Waves</td>
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</tr>
<tr>
<td>PHYE 212 Quantum Mechanics and Statistical Physics</td>
<td>75</td>
<td>3</td>
</tr>
<tr>
<td>PHYE 213 Electronics and Network Theory-I</td>
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<tr>
<td>PHYE 214 Physics and Electronics Laboratory</td>
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B.Sc. (H. S.) FOURTH SEMESTER

<table>
<thead>
<tr>
<th>Major</th>
<th>MARKS</th>
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<tbody>
<tr>
<td>PHYE 221 Electromagnetic Theory</td>
<td>75</td>
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<tr>
<td>PHYE 222 Thermodynamics</td>
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<tr>
<td>PHYE 223 Electronics and Network Theory-II</td>
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<td>PHYE 224 Physics and Electronics Laboratory</td>
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Note: Internal assessment and end semester examination will be of 20% and 80%, respectively, of the total marks.
### FIFTH AND SIXTH SEMESTER EXAMINATION

#### B.Sc. (H. S.) FIFTH SEMESTER

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<tr>
<td>PHYE 311</td>
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<tr>
<td>PHYE 312</td>
<td>Laser Physics</td>
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<td>PHYE 313</td>
<td>Condensed Matter Physics</td>
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<tr>
<td>PHYE 314</td>
<td>Nuclear Physics</td>
<td>75</td>
<td>3</td>
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<tr>
<td>PHYE 315</td>
<td>Digital Electronics and Instrumentation</td>
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<td>PHYE 316</td>
<td>Physics and Electronics Laboratory</td>
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#### B.Sc. (H. S.) SIXTH SEMESTER

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<td>PHYE 322</td>
<td>Atomic and Molecular Physics</td>
<td>75</td>
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<td>PHYE 323</td>
<td>Material Science</td>
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<td>PHYE 324</td>
<td>Particle Physics</td>
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<td>PHYE 325</td>
<td>Communication System</td>
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<tr>
<td>PHYE 326</td>
<td>Major project work</td>
<td>125</td>
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**Note:** 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 and Electronics 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 and Electronics 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 & Electronics (Major) subjects for B.Sc. (Hons. School) in Physics and Electronics 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".
## B.Sc. (H. S.) in Physics - Subsidiary Courses

### FIRST SEMESTER

<table>
<thead>
<tr>
<th>Paper</th>
<th>Marks</th>
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<tbody>
<tr>
<td>Preliminary English</td>
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</tr>
<tr>
<td>Chemistry : Theory Paper (CHS-116)</td>
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<tr>
<td>Chemistry : Practical</td>
<td>25</td>
<td>1</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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<tr>
<td>(For students without background in Mathematics)</td>
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<tr>
<td>Mathematics : Theory Paper</td>
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<tr>
<td>MATH115S: Advanced Calculus and Geometry</td>
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<td>(For students with background in Mathematics)</td>
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### SECOND SEMESTER

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<tr>
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<td>Chemistry : Theory Paper (CHS-126)</td>
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<td>Mathematics : Theory Paper</td>
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<td>MATH125S: Calculus</td>
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<td>MATH135S: Linear Algebra</td>
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### THIRD SEMESTER

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<tr>
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<td>MATH205S: Matrices</td>
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<tr>
<td>Mathematics : Theory Paper</td>
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<tr>
<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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<td>Computer Science : Theory Paper A</td>
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<td>Computer Applications</td>
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<td>Computer Science : Paper C - Practicals</td>
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### FOURTH SEMESTER

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<tr>
<th>Paper</th>
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<tr>
<td>Mathematics : Theory Paper</td>
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<tr>
<td>MATH205S: Matrices</td>
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<td>(For students without background in Mathematics)</td>
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<tr>
<td>Mathematics : Theory Paper</td>
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<tr>
<td>MATH215S: Diff. eqns., Fourier series, Integral transforms &amp; Complex analysis</td>
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<tr>
<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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ENVIRONMENT AND ROAD SAFETY EDUCATION  
(25 hr. course)

UNIT I (ENVIRONMENT)

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.

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

**UNIT II (ROAD SAFETY)**

1. Concept and Significance of Road Safety.
2. Role of Traffic Police in Road Safety.
4. Traffic Signs.
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.

**Examination Pattern:**
- Seventy multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong or un-attempted question).
- The paper shall have two units: **Unit I (Environment) and Unit II (Road Safety).**
- Unit I shall comprise of 50 questions with minimum of 2 questions from each topics 1, and 12 to 15 and minimum of 4 questions from topics 2 to 11.
- Unit II shall comprise of 20 questions with minimum of 1 question from each topics 1 to 10.
- The entire syllabus of Unit I is to be covered in 25 hours and that of Unit II is to be covered in 10 hours.
- All questions are to be attempted.
- Qualifying Marks 33 per cent i.e. 23 marks out of 70.
- Duration of examination: 90 minutes.
- The paper setters are 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. (Hons. School) First Year English Subsidiary (Sem. 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 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.

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 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:

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**.

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**.

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

Q6. 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**.

Q7. 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**.

Q8 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 and ELECTRONICS SYLLABUS FOR B.Sc. (HONS. SCHOOL)
FIRST SEMESTER FOR STUDENTS OF PHYSICS and ELECTRONICS (MAJOR)

PHYE 111 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.


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

PHYE 112 ELECTRICITY AND MAGETISM (45 hrs.) Max. Marks: 15+60 = 75

Objective: This course has been designed to teach the students the basics of electronics, electric current and circuit theory after exposing them to the mathematical tools like complex variable, trigonometric functions and vector calculus.

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:

PHYE 113 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, 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 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 the Semester. Experiment number 1 is compulsory to be performed in First 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, 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 and ELECTRONICS SYLLABUS FOR B.Sc. (HONS. SCHOOL)
SECOND SEMESTER FOR STUDENTS OF PHYSICS and ELECTRONICS (MAJOR)

PHYE 121 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:
Objective: The content of this course has been so arranged that the students are taught about electric and magnetic fields in matter, the field of moving charges, essentials of electromagnetic induction, alternating currents.

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 books 1, 2 and 3.

Recommended Books:
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, 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 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 the Semester. Experiments performed in first semester cannot be repeated. The list of the experiments is same as given in PHYE 113 LABORATORY Course.
(iv) Students will also carry out minor project work in this semester. Project work will be given weightage of two experiments.

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, Light meter, 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 and ELECTRONICS SYLLABUS FOR B.Sc. (HONS. SCHOOL)
THIRD SEMESTER FOR STUDENTS OF PHYSICS and ELECTRONICS (MAJOR)

PHYE 211 : 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 :
PHYE 212: 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:

PHYE 213: 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.

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 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 choosing at least two experiments from section B. Experiments performed in third semester can not be repeated in fourth semester.

List of Experiments:

SECTION A

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.

SECTION B

33. To study the frequency response of CE amplifiers.
34. To study characteristics of a given FET.
35. To study transistor biasing techniques.
36. Use of LDR, LVDT transducers along with electromagnetic (relay) switching.
37. Precision timing measurements in Physics experiments using PC based kits.
38. Verification and design of combinational logic using AND, OR, NOT, NAND and XOR gates.

**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)
Objective: This course has been framed keeping in mind the requirements of the students with respect to the concepts of electromagnetic theory and its applications in physical optics.

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.

II Polarization: Polarization of plane harmonic waves, linear, circular and elliptical polarization, natural light, production of polarized light, Malus’ law, polarization by scattering, Birefringence, quarter-wave and half-wave plates. Double refraction, Nicol prism, analysis of circularly and elliptically polarized light.

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:
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, Cp-Cv, variation of Cv 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:
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.

Power amplifiers- A, B, C, D, AB; Push-pull emitter follower.
JFET- Construction and characteristics, biasing, small signal model and basic circuits, Common-drain and Common-gate circuits.

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 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 choosing at least two experiments from section B. Experiments performed in third semester can not be repeated in fourth semester. The list of the experiments is same as given in PHYE 214 LABORATORY Course.

List of Experiments:

SECTION A

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.

SECTION B

33. To study the frequency response of CE amplifiers.
34. To study characteristics of a given FET.
35. To study transistor biasing techniques.
36. Use of LDR, LVDT transducers along with electromagnetic (relay) switching.
37. Precision timing measurements in Physics experiments using PC based kits.
38. Verification and design of combinational logic using AND, OR, NOT, NAND and XOR gates.

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 and ELECTRONICS SYLLABUS FOR B.Sc. (HONS. SCHOOL)
FIFTH SEMESTER FOR STUDENTS OF PHYSICS and ELECTRONICS (MAJOR)

PHYE 311: 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:
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 crystalplanes, resume of common lattice types (sc, fcc, bcc, hcp, diamond, NaCl, CsCl and 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 noninteracting 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:  
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:
PHYE 315 : DIGITAL ELECTRONICS AND INSTRUMENTATION (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. Digital Electronics:

Electronics: Decimal, binary and hexadecimal number systems, BCD code, Arithmetic of signed and unsigned numbers, simplification of logic expressions - D. Morgan’s theorem and Karnaugh maps. Logic gates and truth tables, inverting and non-inverting buffers, TTL and CMOS families characteristics, logic level, Fan in, Fan out. Encoders, Decoders, Multiplexer, De-multiplexer, RS, JK, D, T flip flops, shift registers, ripple counters, DAC (weighed resistance type), ADC (counter ramp type). Semiconductor Memories - RAM, ROM, PROM, EPROM, EEPROM.


II Instrumentation:


PC interfacing, Serial, parallel and USB ports, IEEE488 Communication.

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 voce 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) Ten experiments are to be performed in fifth Semester. Experiment #36 on microprocessors is compulsory.

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.
37. To understand architecture of microprocessor 8085 and execute programs.
PHYSICS and ELECTRONICS SYLLABUS FOR B.Sc. (HONS. SCHOOL)
SIXTH SEMESTER FOR STUDENTS OF PHYSICS and ELECTRONICS (MAJOR)

PHYE 321: 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.


Tutorials: Relevant problems given in books 1-5.

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. 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:
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 \((\Lambda^0, \Sigma^0, \Sigma^\pm, \Xi^0, \Xi^+, \Omega)\), 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. Communication systems: Basic principles of propagation of e. m. waves through atmosphere and ionosphere: ground wave, sky wave, space waves, dead zones; Communication channels; Frequency, Time and Space division multiplexing.

II. AM Transmission and Reception: Mathematical analysis of AM, Power content of sidebands and carrier.
   Generation of AM signals - Switching modulator, square law modulation, double-sideband suppressed carrier modulation, Ring modulator.
   AM detection - Coherent detection, Costas receiver, Receiver Parameters - Selectivity, Sensitivity, Fidelity; Super heterodyne Receiver.
   Generation of SSB signals - Filter method, Phase Method; Demodulation of SSB-SC signals; Transmission and reception of vestigial side band signals.

III. FM Transmission and Reception: FM allocation standards,
   Generation of FM signals, Direct and Indirect FM, Diode reactance modulator,
   Phase-Locked-Loop, Armstrong method, RC phase shift method, Frequency stabilized reactance FM transmitter, Stereo FM.
   Frequency demodulators, Tuned circuit frequency discriminators; FM detection using PLL.

IV. Pulse Modulation: Sampling theorem, PAM; Frequency Spectra for PAM, Modulator and demodulator circuits. Other forms of pulse modulation PWM, PPM. Companding, Delta Modulation PCM (modulator Receiver), Differential PCM.

V. Digital transmission: Advantages, Pulse code modulation, Sampling, Aliasing, quantisation error, Digital carrier modulation and demodulation techniques: Information capacity, Shannon limit of information capacity, ASK, FSK, PSK, Differential encoder and decoder, Differential PSK, modulators and detectors, carrier recovery, Clock recovery.

VI. Antennas - Wire radiator in space, resonant and Nonresonant (directional) antennas, radiation patterns.
   Relevant terms - Antenna gain, Effective radiated power, Radiation measurement and field intensity, Antenna Resistance, bandwidth, beamwidth and polarization.
   Effects of ground on antennas, Antenna coupling - Impedance matching, Balun.
   Characteristics and applications of various antennas - Directional high frequency antennas - Dipole arrays, Folded Dipole, Rhombic antenna. UHF and Microwave antennas with parabolic reflectors, Horn antennas, Lens antennas, Special-purpose antennas.
**Books**


**PHYE 326 MAJOR PROJECT WORK (135 hrs) Max. Marks: 25+100 = 125**

The aim of project work in B.Sc. (H.S.) 6th semesters is to expose the students to **Instrumentation, Power Electronics, Digital Electronics**. It may include development of pulse processing **electronic modules, power supplies, control equipment for use in a research laboratory, or fabrication of a device.**

A student will be attached to one teacher of the department before the end of the 3rd semester. Scientists and Engineers from other departments of the university and Institutes in and around Chandigarh can act as co-supervisors. A report of about 30 pages about the work done in the project (typed on both the sides of the paper and properly bound) will be submitted by a date to be announced by the UGAPMEC. Assessment of the work done under the project will be carried out by a committee on the basis of effort put in the execution of the project, degree interest shown in learning the methodology, report prepared, grasp of the problem assigned and viva-voce/seminar, etc as per guidelines prepared by the UGAPMEC.

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