COMPULSORY SUBJECT
ENGLISH (801)

Aims (English Language)

To develop the ability to:

- derive, infer and critically assess information through listening.
- express oneself by speaking individually, or in a discussion.
- read with comprehension, drawing information directly or by inference from the text, through an understanding of grammar and structure, vocabulary and idiom.
- employ a variety of skills in writing within a framework using argument or imagination or summarizing.
- use the English language for the purpose of study and social and cultural interaction.
- speak and write clearly and to the purpose, using appropriate grammar, vocabulary and idiom.

Aims (Prescribed Texts)

- To enjoy and appreciate literature through a critical study of selected literary works.
- Through the study of literature:
  - approach an understanding of humanity.
  - develop an interest in the thought and culture of the peoples of the world.
  - develop the power of expression and a sense of aesthetic values.

CLASSES XI & XII

The subject English has ***two*** components, ***English Language*** and ***Literature in English.*** Each of these components will consist of a ***Theory Paper*** of 80 Marks and ***Project Work*** of 20 Marks.

ENGLISH LANGUAGE

*There will be **two** papers in English Language:*

Paper I: *Theory (3 hours): 80 Marks*

Paper II: *Project Work: 20 Marks*

PAPER I: THEORY - 80 Marks

All *questions will be compulsory.*

Question One:

A composition on one of a number of subjects.

Question Two:

(a) Directed writing.

(b) Proposal Writing based on a given situation.

Question Three:

Short-answer questions to test grammar, structure and usage

Question Four:

Comprehension.

Question One

Candidates will be required to select ***one*** composition topic from a choice of ***six.*** The choice will normally include narrative, descriptive, reflective, argumentative, discursive topics and original short story.

The required length of the composition is **400 – 450** words.

The main criteria by which the compositions will be marked are as follows:

(a) The quality of the language employed, the range and appropriateness of vocabulary and sentence structure, syntax, the correctness of grammatical constructions, punctuation and spelling.

(b) The degree to which candidates have been successful in organising the content of the composition as a whole and in individual paragraphs.

Question Two

There are ***two*** parts in this question and ***both*** parts are compulsory.

(a) Directed Writing

The piece of directed writing must be based on the information and all the points provided. The required length is 250-300 words. The range of subjects includes feature article, book review, speech writing, newspaper report and statement of purpose.

Skills such as amplifying, describing and re-stating are involved. The candidates' ability in the above skills, including format, will be taken into account as well as their ability to handle language appropriately in the context of the given situation.

(b) Proposal Writing

Candidates will be required to write a proposal based on a given situation.

The proposal should include (i) An Introduction (ii) Objectives (iii) List of measures to be taken. A concluding statement is necessary.

The format prescribed by the CISCE must be followed. The candidates will also be marked on linguistic ability.

Question Three

All the items in this question are compulsory and their number and type / pattern may vary from year to year. They will consist of transformation of sentences, phrasal verbs, and verbs/tenses, which will test the candidates' knowledge of the essentials of functional English grammar and structure.

Question Four

A passage of about 700 words will be provided.

Questions based on the passage will be as follows:

- Questions that test the candidates' analytical skills, knowledge of vocabulary, ability to understand the content, infer information and meanings from the text.
- A question that elicits the main ideas of all or part of the passage, where the candidate will be required to frame a summary (keeping to a word limit), in a coherent manner. Marks will be awarded for expression and the candidate's ability to summarise clearly in complete sentences. Marks will be deducted for linguistic errors.

  NOTE: This part must be done in the grid form. Use of abbreviations and contractions will not be accepted.

PAPER II: PROJECT WORK - 20 Marks

In addition to the syllabus prescribed above for Classes XI and XII, candidates are also required to be assessed in Project Work.

PROJECT WORK FOR CLASS XI

Project Work in Class XI consists of assessment of candidates in **Listening** and **Speaking Skills** which are to be assessed ***internally***, by the school, during English course work and shown in the student's report and school record.

Candidates are to be assessed in ***two*** projects, one on Listening Skills and one on Speaking Skills.

Details of assignments for Project Work on Listening and Speaking Skills are given below:

Listening Skills

An unseen passage of about 500 words is to be read aloud, twice, the first time at normal reading speed (about 110 words a minute) and the next time at a slower speed. The passage may be taken from any novel, newspaper, magazine article, journal and so on but **not from an ICSE or ISC textbook**. Students may make brief notes during the readings followed by answering objective type questions based on the passage, on the paper provided.

Speaking Skills

Students are to be assessed through an individual presentation of about three minutes followed by a discussion with the subject teacher, for another two or three minutes. Some of the themes which may be addressed are:

1. Narrating an experience
2. Giving directions or instructions on how to make or operate something
3. Providing a description
4. Giving a report
5. Expressing an opinion or a theme-based conversation

Internal Evaluation by the Teacher (20 Marks):

Assessment Criteria	Description	Marks
Listening Skills (Aural)	Response to questions based on listening comprehension	10
Speaking Skills (Oral)	- Content	2
	- Fluency	2
	- Vocabulary	2
	- Sentence structure	2
	- Confidence	2
TOTAL		**20**

PROJECT WORK FOR CLASS XII

Project Work in Class XII consists of assessment of candidates in ***three*** projects, ***one each*** on **Listening**, **Speaking** and **Writing skills**.

Listening and Speaking skills are to be **assessed internally**, by the School, during English course work in Class XII.

Writing Skills are to be **assessed externally** by the Visiting Examiner, appointed locally and approved by CISCE.

Details of assignments for Project Work are given below:

Listening Skills (to be internally assessed by the subject teacher)

An unseen passage of about 500 words may be read aloud, twice, the first time at normal reading speed (about 110 words a minute) and the next time at a slower speed. The passage may be taken from any novel, newspaper, magazine article, journal and so on but **not from an ICSE or ISC textbook**. Students may make brief notes during the readings followed by answering objective type questions based on the passage, on the paper provided.

Speaking Skills (to be internally assessed by the subject teacher)

Students are to be assessed through an individual presentation of about three minutes followed by a discussion with the subject teacher, for another two or three minutes.

Some of the themes which may be addressed are:

1. Narrating an experience
2. Giving directions or instructions on how to make or operate something
3. Providing a description
4. Giving a report
5. Expressing an opinion or a theme-based conversation

Writing Skills (to be externally assessed by the Visiting Examiner)

A piece of written work of about 500 words must be produced.

List of suggested assignments for Project Work:

1. The text of a brochure
2. A product description
3. A process description (e.g. instruction to operate a device, a recipe, a scientific experiment)
4. Description of a sporting event
5. An autobiographical experience
6. Review of a television serial

EVALUATION

Marks (out of a total of 20) should be distributed as given below:

1.	Internal Evaluation by Teacher* • Listening Skills (Aural) • Speaking Skills (Oral)	 5 Marks 5 Marks
2.	Evaluation by Visiting Examiner of Writing Skills**	10 Marks
TOTAL		**20 Marks**

*** Internal Evaluation by the Teacher (10 Marks):**

Assessment Criteria	Description	Marks
Listening Skills (Aural)	Response to questions based on listening comprehension	5
Speaking Skills (Oral)	- Content - Fluency - Vocabulary - Sentence structure - Confidence	1 1 1 1 1
TOTAL		**10**

****Criteria for Evaluation by the Visiting Examiner (10 Marks):**

Assessment Criteria		Description	Marks
1.	Presentation	Overall formatting (headings, sub-headings, paragraphing) within a word limit of 500 words and a separate title page.	2
2.	Originality	No plagiarism	2
3.	Use of appropriate language	Use of suitable terminology, vocabulary and illustrations for the specific task chosen.	2
4.	Structure	Must read as a unified whole.	2
5.	Style	Lucid style, which communicates the message effectively	2
TOTAL			**10**

LITERATURE IN ENGLISH (PRESCRIBED TEXTS)

*There will be **two** papers in Literature in English:*

***Paper I:** Theory (3 hours): 80 Marks*

***Paper II**: Project Work: 20 Marks*

PAPER I: THEORY – 80 Marks

Candidates will be required to answer questions based on the prescribed textbooks, which include Drama, Prose (Short Stories) and Poetry.

Drama and Prose (Short Stories)
Questions set will be central to the text. Candidates will be required to show that they have understood the questions asked and are able to clearly respond in their own words. Questions will test understanding, appreciation and ability to analyse and synthesise.

Poetry
Questions on a poem or a group of poems will be set to test the candidates' response. The questions will focus on the content, understanding and the personal response of candidates to the entire poem. Candidates' ability to appreciate content, stylistic and literary features of the poem(s) in question will also be tested.

SYLLABUS TO BE COVERED

Class XI

I. DRAMA*: Macbeth - William Shakespeare*
(Acts I & II)

II. PRISM: A Collection of ISC Short Stories
(Evergreen Publications (India) Ltd. New Delhi)

1. *A Living God – Lafcadio Hearn*
2. *Advice to Youth – Mark Twain*
3. *The Paper Menagerie – Ken Liu*
4. *The Great Automatic Grammatizator – Roald Dahl*
5. *Thank You, Ma'am – Langston Hughes*

III. RHAPSODY: A Collection of ISC Poems
(Evergreen Publications (India) Ltd. New Delhi)

1. *Abhisara: The Tryst – Rabindranath Tagore*
2. *Why I Like the Hospital – Tony Hoagland*
3. *Sonnet 116 – William Shakespeare*
4. *Death of a Naturalist – Seamus Heaney*
5. *Strange Meeting – Wilfred Owen*

NOTE: The Class XI Examination is to be conducted on the portion of the syllabus that is prescribed for Class XI

Class XII

I. DRAMA: *Macbeth: William Shakespeare*
(Acts III, IV & V)

II. PRISM: A Collection of ISC Short Stories
(Evergreen Publications (India) Ltd. New Delhi)

1. *Atithi / Guest – Rabindranath Tagore*
2. *The Cookie Lady – Philip K. Dick*
3. *There Will Come Soft Rains – Ray Bradbury*
4. *Indigo – Satyajit Ray*
5. *The Medicine Bag – Virginia Driving Hawk Sneve*

III. RHAPSODY: **A Collection of ISC Poems**
(Evergreen Publications (India) Ltd. New Delhi)

1. *Telephone Conversation – Wole Soyinka*
2. *Tithonus – Alfred, Lord Tennyson*
3. *Beethoven – Shane Koyczan*
4. *Small Towns and the River – Mamang Dai*
5. *Death be not Proud – John Donne*

NOTE: The ISC (Class XII) Examination paper will be set ONLY on the portion of the syllabus that is prescribed for Class XII.

PAPER II: PROJECT WORK - 20 Marks

In addition to the syllabus prescribed above for Classes XI and XII, candidates are also required to be assessed in Project Work. Project Work consists of assessment of **Writing Skills** in Classes XI and XII. The objective is to produce original, creative and insightful perspectives on the drama/short stories/poems.

PROJECT WORK FOR CLASS XI

Project Work in Class XI consists of assessment of Writing Skills (***only from the syllabus to be covered in Class XI***) which are to be assessed ***internally*** by the School.

Candidates will be required to undertake ***one written assignment*** **of 1000-1500 words**, which should be structured as given below:

A. The written assignment must be given a title in the form of a question which should allow the candidate to explore the drama or the chosen short stories/poems in depth.

B. The written assignment must follow the structure given below:

- Introduction:
  - Explanation of the question that has been framed
  - Reason for choosing the text
  - Brief explanation of how the candidate intends to interpret the chosen text and literary materials used in the process
- Main Body – organised and well-structured treatment of the question using appropriate sub-headings.
- Conclusion – comprehensive summary of the points made in the main body.

Internal Evaluation by the Teacher (20 Marks):

Assessment Criteria		Candidates should be able to:	Marks
1.	Process	- Identify the topic. - Plan a detailed written assignment. - Produce a written outline.	6
2.	Understanding, Application of Knowledge and Analysis	Use a range of literary aspects such as plot, setting, characters, action, style and ideas in order to present an organized and well-structured complete assignment.	8
3.	Presentation	Prepare the document (overall format: headings, sub-headings, paragraphing) writing within a word limit of 1000-1500 words and provide a separate title page.	6
TOTAL			**20**

List of suggested assignments for Project Work:

1. Analysis of a theme from any short story/ poem in the prescribed texts.
2. Analysis of a character from the drama or any short story/poem in the prescribed texts.
3. Background – historical, cultural, literary context and relevance of the writer/poet chosen.
4. Summary / paraphrase of the chosen text.
5. Appreciation of literary qualities of the chosen text.
6. Identifying with a character in the chosen text and presenting his/her personal perspective.
7. Imagining an alternate outcome or ending or extension of the chosen text and its impact on the plot/setting/characters/mood and tone.
8. Comparing and contrasting two characters/themes from different short stories/poems of the prescribed texts.

PROJECT WORK FOR CLASS XII

Project Work in Class XII consists of assessment of **Writing Skills** which are **to be assessed internally by the subject teacher and externally by the Visiting Examiner** appointed locally and approved by CISCE.

Candidates will be required to undertake ***one written assignment*** **of 1000-1500 words,** which should be structured as given below:

A. The written assignment must be given a title in the form of a question which should allow the candidate to explore the drama or the chosen short stories/poems in depth.

B. The written assignment must follow the structure given below:

- Introduction:
  - Explanation of the question that has been framed
  - Reason for choosing the text
  - Brief explanation of how the candidate intends to interpret the chosen text and literary materials used in the process
- Main Body – organised and well-structured treatment of the question using appropriate sub-headings.
- Conclusion – comprehensive summary of the points made in the main body.

Note: The text/texts analysed in the Class XI Project Work must not be repeated in Class XII.

EVALUATION

Marks (out of a total of 20) should be distributed as given below:

1.	Internal Evaluation by Teacher*	10 marks
2.	Evaluation by Visiting Examiner**	10 marks
TOTAL		**20 marks**

*** Internal Evaluation by the Teacher (10 Marks):**

Assessment Criteria		**Candidates should be able to:**	**Marks**
1.	Process	Identify the topic. Plan a detailed written assignment. Produce a written outline.	3
2.	Understanding, Application of Knowledge and Analysis	Use a range of literary aspects such as plot, setting, characters, action, style and ideas in order to present an organized and well-structured complete assignment.	4
3.	Presentation	Prepare the document (overall format: headings, sub-headings, paragraphing) writing within a word limit of 1000-1500 words and provide a separate title page.	3
TOTAL			**10**

****Criteria for Evaluation by the Visiting Examiner (10 Marks)**

Assessment Criteria		Candidates should be able to:	Marks
1.	Presentation	Prepare the document (overall format: headings, sub-headings, paragraphing) writing within a word limit of 1000-1500 words and provide a separate title page.	4
2.	Understanding, Application of Knowledge and Analysis	Use a range of literary aspects such as plot, setting, characters, action, style and ideas in order to present an organized and well-structured complete assignment.	6
TOTAL			**10**

List of suggested assignments for Project Work:

1. Analysis of a theme from any short story/poem in the prescribed texts.
2. Analysis of a character from the drama or any short story/poem in the prescribed texts.
3. Background – historical, cultural, literary context and relevance of the writer/poet chosen.
4. Summary / paraphrase of the chosen text.
5. Appreciation of literary qualities of the chosen text.
6. Identifying with a character in the chosen text and presenting his/her personal perspective.
7. Imagining an alternate outcome or ending or extension of the chosen text and its impact on the plot/setting/characters/mood and tone.
8. A script for dramatization, based on the short story/poem chosen.
9. Writing a short story based on a poem.
10. Comparing and contrasting two characters/themes from different short stories/poems of the prescribed texts.

Note: No Question Paper for Project Work will be set by CISCE.

ELECTIVE SUBJECTS

INDIAN LANGUAGES

Aims:

1. To enable students to use the language to communicate thoughts, ideas and information.
2. To develop the ability to use the language innovatively and creatively for interpreting and summarising information gained through various learning experiences.
3. To develop the habit of clear articulate expression, using accepted syntactical forms and structures in the language.
4. To expose students to a deeper knowledge and appreciation of all categories of literary works in the language.

CLASSES XI & XII

There will be two papers in the subject:

Paper I - *Theory: 3 hours…… 80 Marks*

Paper II - *Project Work ……. 20 Marks*

PAPER I (THEORY): 80 Marks

There will be one paper of ***three*** *hours duration, which will consist of two sections:*

Section A*: Language (40 marks)*

Section B*: Prescribed Textbooks (40 marks)*

SECTION A

LANGUAGE – 40 Marks

This section will consist of **three** questions, all of which will be compulsory.

1. **Composition:** One composition of 400 words approximately, in the language, to be written out of a choice of 6 topics set within the experience and mental maturity of the age-group of the candidates.

2. **Comprehension:** An unseen passage of about 300 words to be set with questions and/or summary (with heading to test the ability to summarise and/or to expand an idea given in the passage).

3. **Grammar:** Functional grammar - correction of sentences and using words/idioms in sentences, viz. correct structure with proper agreement of the subject and verb according to the number, gender, case, tense and voice.

SECTION B

PRESCRIBED TEXTBOOKS – 40 Marks

Candidates will be required to answer **four** questions from **any three** of the prescribed textbooks.

NOTE: *The Class XII - ISC Examination paper will be set on the entire syllabus prescribed for the subject.*

The Class XI Examination is to be conducted on the portion of this syllabus that is covered during the academic year.

The CISCE has not prescribed bifurcation of the syllabus prescribed for this subject.

For list of Prescribed Textbooks, see Appendix I.

PAPER II (PROJECT WORK): 20 Marks

In addition to the syllabus prescribed above for Classes XI and XII, candidates are also required to be assessed in Project Work. Details of the same are given below:

PROJECT WORK FOR CLASS XI

Project Work in Class XI comprises of assessment of candidates in Listening, Speaking and Writing skills. These are to be ***assessed internally*** by the School, during course work and shown in the student's report and school record.

Candidates are to be assessed in ***three*** projects, one each on **Listening, Speaking** and **Writing Skills.**

Details of Projects in Listening, Speaking and Writing Skills are given below:

Listening Skills

An unseen passage of about 500 words or a poem (of appropriate length) may be read aloud, twice, the first time at normal reading speed and the next time at a slower speed. The passage/poem may be taken from any book, newspaper, magazine, journal and so on but **not from an ICSE or ISC textbook**. A suitable audio clip may also be used.

Students may make brief notes during the readings/playing of the audio clip, followed by answering objective type questions based on the passage/poem/audio clip, on the paper provided.

Speaking Skills

Students are to be assessed through an individual presentation, e.g. extempore speaking, declamation, recitation, debate, of about three minutes followed by a discussion with the subject teacher, for another two or three minutes.

List of suggested assignments for Project Work:

1. Narrating an experience
2. Giving directions or instructions on how to make or operate something
3. Providing a description
4. Giving a report
5. Expressing an opinion or a theme-based conversation
6. Giving a speech on a selected topic
7. Reading out, after correcting, a grammatically incorrect passage/s of suitable length (150- 200 words) based on the prescribed grammar syllabus.

Writing Skills (Language/Literature)

A piece of written work of about 600 – 800 words must be produced on any aspect of Language or the portion of the Literature syllabus covered in Class XI.

List of suggested assignments for Project Work:

1. Product/process description
2. Description of an event
3. An autobiographical experience
4. Review of a book/serial/play/performance
5. Summary or paraphrase of a chosen text from the syllabus
6. Selecting another story/poem on a theme studied in the syllabus and writing a summary of it
7. Giving an alternative title to a story or poem studied in the syllabus and justifying the same

EVALUATION

Internal Evaluation by the Teacher (20 Marks):

Assessment Criteria	Description	Marks
Listening Skills (Aural)	Response to questions based on listening comprehension	6
Speaking Skills (Oral)	Content, Fluency, Vocabulary, Sentence structure, Confidence level	6
Writing Skills	Process, Content, Presentation, Originality	8
TOTAL		**20**

PROJECT WORK FOR CLASS XII

Project Work in Class XII comprises of assessment of candidates in ***three*** projects, ***one each*** on **Listening, Speaking** and **Writing Skills**.

Listening and Speaking skills are to be **assessed internally**, by the School in Class XII.

Writing Skills are to be **assessed externally** by the **Visiting Examiner, appointed locally and approved by the CISCE.**

Details of assignments for Project Work are given below:

Listening Skills (to be internally assessed by the subject teacher)

An unseen passage of about 500 words or a poem (of appropriate length) may be read aloud, twice, the first time at normal reading speed and the next time at a slower speed. The passage/poem may be taken from any book, newspaper, magazine, journal and so on but **not from an ICSE or ISC textbook**. A suitable audio clip may also be used.

Students may make brief notes during the readings/playing of the audio clip, followed by answering objective type questions based on the passage/poem/audio clip, on the paper provided.

Speaking Skills (to be internally assessed by the subject teacher)

Students are to be assessed through an individual presentation, e.g. extempore speaking, declamation, recitation, debate, of about three minutes followed by a discussion with the subject teacher, for another two or three minutes.

List of suggested assignments for Project Work:

1. Narrating an experience
2. Giving directions or instructions on how to make or operate something
3. Providing a description
4. Giving a report
5. Expressing an opinion or a theme-based conversation
6. Giving a speech on a selected topic
7. Reading out, after correcting, a grammatically incorrect passage/s of suitable length (150 - 200 words) based on the grammar syllabus prescribed for Classes XI and XII.

Writing Skills (Literature): to be assessed externally by the Visiting Examiner

Candidates will be required to undertake ***one written assignment of 1000-1500 words*** on a text/texts studied in the Literature syllabus.

The objective is to produce original, creative and insightful perspectives on a literary text or set of texts which may be from the short stories/ poems/ drama/ novel from the syllabus.

The text/texts analysed in the Class XI Project Work must not be repeated in Class XII.

List of suggested assignments for Project Work:

1. Writing a short story based on a poem.
2. Writing a poem based on a story.
3. Analysing the relevance of a selected story/couplets in the present-day context.
4. Imagining an alternate outcome or ending or extension of the chosen text and its impact on the plot/setting/characters/mood and tone.
5. Providing an alternate title to a given text and giving a justification for the same.
6. Imagining oneself as one of the main characters of the story/novel/drama and describing what one would like to change in the story/novel/drama, giving reasons for the same.
7. Analysing the theme of the story/poem/novel and expressing one's opinion on the same.
8. Summarising / paraphrasing of the chosen text.

9. Preparing a script for dramatization, based on the short story/poem chosen.
10. Comparing and contrasting two characters/themes from different short stories/poems of the prescribed texts.
11. Appreciation of literary qualities of the chosen text.
12. Analysing the background (historical, cultural, literary context) and relevance of the works of the writer/poet chosen.
13. Critical analysis of a news story published in four different newspapers.
14. Writing an article for a newspaper (news writing of an event).

EVALUATION

Marks (out of a total of 20) should be distributed as given below:

1.	Internal Evaluation by Teacher* Listening Skills (Aural) Speaking Skills (Oral)	 5 Marks 5 Marks
2.	External Evaluation by the Visiting Examiner of Writing Skills**	10 Marks
TOTAL		**20 Marks**

***Internal Evaluation by the Teacher (10 Marks)**

Assessment Criteria	Description	Marks
Listening Skills (Aural)	Response to questions based on listening comprehension	5
Speaking Skills (Oral)	Content, Fluency, Vocabulary, Sentence structure, Confidence	5
TOTAL		**10**

****Evaluation by the Visiting Examiner (10 Marks)**

Assessment Criteria and Description		Marks
1.	Process (Identification of the topic, planning and preparing a written outline)	2
2.	Presentation (Overall formatting: headings, sub-headings, paragraphing, writing within the word limit and providing a separate title page)	2
3.	Content (Use a range of literary aspects in order to present an organized and well-structured complete assignment with proper introduction, main body and conclusion)	4
4.	Originality	2
TOTAL		**10**

NOTE: No question paper for Project Work will be set by the CISCE.

ELECTIVE ENGLISH (850)

Aims:

1. To provide candidates with a wider course in Elective English than offered in the compulsory English paper.
2. To expose candidates to a deeper knowledge and appreciation of literary works in English.

CLASSES XI & XII

There will be two papers in the subject:

Paper I - *Theory: 3 hours…… 80 Marks*

Paper II - *Project Work ……. 20 Marks*

PAPER I (THEORY): 80 Marks

Candidates will be required to answer-questions on ***any three*** *of the prescribed textbooks.*

1. The questions in the paper will be broadly based on the following categories:

   (i) Prose

   (ii) Drama

   (iii) Poetry

   The question may be character-based, incident based, general broad based, theme based or require critical evaluation.

2. Students will need to study and have a knowledge of the following:

   (a) **<u>Prose and Drama</u>**

   (i) Life of the playwright and novelist and important events therein.

   (ii) Evaluation of characters and the roles played by them in the text.

   (iii) Description of each incident in the play or novel and its significance.

   (iv) Important themes and motifs of the text.

   (v) Relationships between characters and incidents.

   (vi) Patterns and nuances of the text.

   (vii) Fantasy and the supernatural.

   (viii) Stylistic and narrative devices.

   (ix) Students' personal response to and assessment of the novel/play.

   (x) Humour, pathos, tragedy, sarcasm and so on in the texts.

   (xi) The novel/play in the context of contemporary society.

   (b) **<u>Poetry</u>**

   (i) Different types of poems with their characteristics and features:

   - lyric
   - sonnet – both Petrarchan (Italian) and Shakespearean
   - ballad
   - elegy
   - blank verse
   - free verse
   - narrative poetry
   - pastoral poetry
   - dramatic monologue
   - romantic poetry

   (ii) All literary devices in detail and how to recognize them:

   - simile
   - metaphor
   - personification
   - apostrophe
   - alliteration
   - assonance

- repetition
- irony
- imagery
- enjambment
- pun
- contrast
- climax and anti-climax
- onomatopoeia
- hyperbole
- oxymoron
- litotes
- symbolism

(iii) A thorough knowledge of the poets' lives and styles of writing.

(iv) Important themes of the poems.

(v) Patterns and nuances of the poems.

(vi) Fantasy and the supernatural if present in any poem.

(vii) Symbolism and Imagery.

(viii) How to write a proper Critical Evaluation / Appreciation, which must contain the following components:

- Life of the poet and how it has impacted his/her style of writing
- Autobiographical element in the poem
- Type of poem
- Setting
- Theme
- Mood and atmosphere
- Different levels of meaning in the poem, if any
- Rhyme scheme and its significance
- Symbolism
- Imagery
- Literary devices
- The student's own personal response to the poem.

Note: *Credit is given for textual detail and for the candidate's own response.*

Candidates are advised to exercise their options with great care, keeping in view their knowledge and understanding of the question(s) chosen. Candidates are also expected to be precise and to avoid unnecessary details.

For list of prescribed Textbooks, see Appendix I.

PAPER II (PROJECT WORK): 20 Marks

In addition to the syllabus prescribed above for Classes XI and XII, candidates are also required to be assessed in Project Work.

Details of the same are given below:

PROJECT WORK FOR CLASS XI

The candidates will produce original, creative, critical/ analytical, insightful perspectives on any **TWO** of the texts (novel/ poetry/ drama – to be taken only from the syllabus to be covered in Class XI) that they have chosen to study.

Project Work in Class XI (***only from the syllabus to be covered in Class XI***) is to be assessed ***internally*** by the School.

Candidates will be required to complete ***two*** projects:

A. One **written assignment (800 to 1000 words)**

and

B. One **Audio-visual (PPT) presentation (15 to 20 minutes duration)**

A. The *written assignment* should be organised in the following manner:

1. The title of the assignment/ presentation should be in the form of a question that allows the candidate to explore and critically analyse the specified text(s).
2. The assignment should follow the structure given below:
   - An introduction that states the reason for choosing that particular topic/ question and text. Teachers could assist by suggesting a list of questions.
   - A brief description of the methods adopted – what did the candidate do to answer the research question?
   - Results – What was the answer to the question? What were the candidate's findings?
   - Conclusion – A brief discussion on the significance of the project and the candidate's own perspective / views on the question.
   - Candidates should include a bibliography that mentions ALL the material that they referred to.

Assessment Criteria for the Written Assignment

Marks will be awarded as per the criteria given below (10 Marks):

Assessment Criteria		Candidates should be able to:	Marks
1.	Process	- Choose topic/question. - Plan a detailed assignment. - Submit a written outline for approval.	2
2.	Content	- Give an interesting introduction that presents a clear explanation and scope of the topic - present information in a cohesive well-structured manner - display a knowledge of the topic by referring to other sources - sum up main points in conclusion	4
3.	Presentation and References	Prepare a document of 800 to 1000 words The document should have: - a title page stating the topic/ question - an introduction - appropriate headings and sub-headings - a well worded conclusion that ties together all the main points made	4
TOTAL			**10**

B. The Audio-visual presentation (15 to 20 minutes duration)

The Audio-visual Presentation should be organised in the following manner:

1. The presentation should be in the form of a powerpoint presentation with 20 to 25 slides.
2. The presentation is to last between 15 to 20 minutes.
3. The title slide of the presentation should be in the form of a question that allows the candidate to explore and critically analyse the specified text(s). The last slide should be an acknowledgement of the references used to create the presentation.
4. The presentation should follow the structure given below:
   - An introduction that states the reason for choosing that particular topic/ question and text. (Teachers could assist by suggesting a list of questions).
   - A brief description of the methods adopted – what did the candidate do to answer the research question?
   - Results – What was the answer to the question? What were the candidate's findings?
   - Conclusion – A brief discussion on the significance of the project and the candidate's own perspective / views on the question.
5. The slide presentation must make judicious use of AV clips/ pictures, animations and effects to create interest.

EVALUATION

Criteria for Evaluation by the Teacher

(10 Marks)

Assessment Criteria		**Candidates should be able to:**	**Marks**
1.	Organisation/ content	- state topic and scope of presentation in the introduction - explain what s/he intends to cover within the allotted time - display a knowledge of topic by referring to other sources - sum up main points in conclusion	4
2.	Presentation	- display confidence and maintain eye contact - speak clearly, correctly, distinctly and confidently - maintain the interest of the audience - explain thoughts and ideas - not read from a paper/ off the slides - use visual/audio clips/ pictures/ effects and animation, etc. effectively	2
3.	Discussion	- use appropriate strategies to initiate discussion handle questions/ comments from the class - deal confidently with question posed by teacher - effectively raise a question and increased the class' knowledge of the topic through the presentation	4
TOTAL			**10**

List of suggested assignments for Project Work:

1. Choose a text from the ones prescribed in your syllabus, and conduct a thorough research on the background, social-cultural and political milieu, the author's own life experiences, his emotional and psychological concerns that might have influenced /impacted or affected his/ her piece of writing.
2. How have the genre, stylistic techniques, and characters- their costumes, personalities, and language spoken by them, helped the text chosen by you emerge as an engrossing and an engaging piece of literary work?
3. The texts that you have read have protagonists that have shaped the plot, setting, relationships and conclusion. If you were given a chance to choose a protagonist from one of the characters in the same text, who would it be, and why? How would he/she shape the plot, setting, relationships and the conclusion of your chosen text?
4. Compare and contrast the technical novelties of any two poets prescribed in your syllabus.

Note: The Powerpoint presentation and the written assignment <u>should not be based on the same text.</u>

PROJECT WORK FOR CLASS XII

Project Work in Class XII is **to be assessed internally by the subject teacher and externally by the Visiting Examiner** appointed locally and approved by CISCE.

The candidates will produce original, creative, critical/ analytical, insightful perspectives on any **ONE** text (novel/ poetry/ drama – to be taken only from the syllabus to be covered in Class XII) that they have chosen to study.

Candidates will be required to produce **ONE written assignment** (1000 to 1500 words).

The written assignment should be organised in the following manner:

1. The title of the assignment should be in the form of a question that allows the candidate to explore and critically analyse the specified text(s).
2. The assignment should follow the structure given below:
   - An introduction that states the reason for choosing that particular topic/ question and text. Teachers could assist by suggesting a list of questions.
   - A brief description of the methods adopted – what did the candidate do to answer the research question?
   - Results – What was the answer to the question? What were the candidate's findings?
   - Conclusion – A brief discussion on the significance of the project and the candidate's own perspective / views on the question.
   - Candidates should include a bibliography that mentions ALL the material that they referred to.

Note: The text/texts that is/are analysed should be chosen from the prescribed syllabus for grade XII.

EVALUATION

Marks (out of a total of 20) should be distributed as given below:

1.	Internal Assessment by the Teacher*	10 Marks
2.	External Evaluation by the Visiting Examiner **	10 Marks
TOTAL		**20 Marks**

***Internal Assessment Criteria for the Written Assignment by the Teacher:**

Assessment Criteria		**Candidates should be able to:**	**Marks**
1.	Process	Identify the topic. Plan a detailed written assignment. Produce a written outline.	3
2.	Understanding, Application of Knowledge and Analysis	Use a range of literary aspects such as plot, setting, characters, action, style and ideas in order to present an organized and well-structured complete assignment.	4
3.	Presentation	Prepare the document (overall format: headings, sub-headings, paragraphing) writing within a word limit of 1000 - 1500 words and provide a separate title page.	3
TOTAL			**10**

****External Evaluation by the Visiting Examiner:**

Assessment Criteria		Candidates should be able to:	Marks
1.	Presentation	The project should adhere to the word limit of 1000 to 1500 words. The document should have: - a title page stating the topic/ question - an introduction, - appropriate headings and sub-headings - a well worded conclusion that ties together all the main points made an acknowledgement of all sources of information/ references in a proper format	4
2.	Content knowledge	- Give an interesting introduction that presents a clear explanation and scope of topic - present information in a cohesive well structured manner - display a knowledge of topic by referring to other sources - sum up main points in conclusion	6
TOTAL			**10**

List of suggested assignments for Project Work:

1. How do the plot, setting, characters, action and stylistic techniques contribute to the evolution of a successful literary work? What in your opinion constitutes a 'relevant' text?
2. Compare a prescribed text to another text of the same genre on a similar topic that you have read. What are the interesting similarities /dissimilarities that you have discovered?
3. In what ways would a text of your choice be different if it were set in another era?
4. If you were given an opportunity to make changes in the text chosen by you, what would they be? Discuss in detail why you think these changes would make it more appealing and engrossing.
5. If you could choose a character from a text as your alter ego, who would it be and why? Would you like to change the responses that were made by the character to the events in the plot? Give your reasons for the same.

Note: No Question Paper for Project Work will be set by CISCE.

HISTORY (851)

Aims:

1. To provide accurate knowledge of significant events and personalities of the period under study, in sequence and in context.
2. To familiarize candidates with factual evidence upon which explanations or judgements about the period must be founded.
3. To develop an understanding of the existence of problems and relevance of evidence of explanations.
4. To develop the capacity to marshal facts and evaluate evidence and to discuss issues from a historical point of view.
5. To develop the capacity to read historical views in the light of new evidence or new interpretation of evidence.
6. To foster a sense of historical continuity.
7. To encourage diminution of prejudices and to develop a more international approach to world history.
8. To develop the ability to express views and arguments clearly using correct terminology of the subject.
9. To familiarise candidates with various types of historical evidence and to provide some awareness of the problems involved in evaluating different kinds of source materials.

CLASS XI

*There will be **two** papers in the subject:*

Paper I: Theory 3 hours ------ 80 marks

Paper II: Project Work -------20 marks

PAPER I (THEORY) – 80 Marks

SECTION A

INDIAN HISTORY

1. Emergence of the Colonial Economy

(i) Development of the means of transport and communication.

Transportation: a brief look at the development of the railways.

(ii) Effect of British revenue policy:

Impact on peasants and artisans

Disruption of the traditional economy.

A general account of the impact of the British revenue policies on peasants and artisans.

(iii) Development of modern industries.

An account of the growth of large scale machine based industries in western India, its economic impact.

(iv) Colonial Forest Policy - impact on local communities.

An overview of the 19th century Colonial Forest Policy. Political and economic impact of the Colonial Forest Policy on local communities.

2. Social Movements

(i) Struggle against caste – Jyotirao Phule, Narayan Guru, Veerasalingam.

A brief outline of their contributions to Indian society.

(ii) The Women's Question

Women's condition in India in the 19th century. Features of the following Acts: Abolition of Sati (1829), Widow Remarriage (1856), Female Infanticide Prevention (1870) and Age of Consent (1891) - their impact on Indian women.

3. Protest Movements against Colonial Rule

Circumstances that led to different protest movements: *the Indigo Uprising (1859), Deccan riots (1875), Munda Uprising (1899-1900) and the impact on the colonial policies.*

4. Growth of Nationalism

(i) Swadeshi Movement

Partition of Bengal and anti-Partition Movement including the Swadeshi and Boycott Movement: causes and Impact of the Movement.

(ii) Foundation of the Muslim League.

Circumstances leading to its foundation.

Objectives of the Muslim League.

5. Gandhian Nationalism (1916 – 1922)

(i) Agitation against the Rowlatt Act, Jallianwala Bagh (1919).

The reasons behind the Rowlatt Act and its main terms to be studied in brief. A general account of the satyagraha against the Act, leading to Jallianwala Bagh.

(ii) The launching of the passive resistance movement by Gandhi: Khilafat and Non-Cooperation Movement (1919-1922).

The launching of the Khilafat and the Non-Cooperation Movements. There should be a connected chronological account of both the movements and their suspension.

6. Gandhian Nationalism (1927 – 1937)

(i) Lahore session and declaration of 'Poorna Swaraj' as the Congress objective.

Events leading to the Lahore session – Simon Commission: a brief explanation of the reasons for its boycott; demand for Dominion Status by 1929 (Nehru Report).

The main points of the Poorna Swaraj Resolution.

(ii) Civil Disobedience Movement (1930-1934).

A general account of the features of the Movement; main terms of the Gandhi-Irwin Pact; the 1st and 2nd Round Table Conferences; resumption of the Movement and the Poona Pact.

(iii) Government of India Act, 1935.

The main features of Government of India Act, 1935 should be explained.

A critical account of the election of 1937. A summary of the main developments under Congress and non-Congress ministries should be included.

SECTION B

WORLD HISTORY

7. World War I: Causes, events leading to it; Peace settlements

(i) Main long-term causes: alliance system, imperialism, militarism (arms race), nationalism.

Main short-term causes: events from 1908 to 1914.

(ii) Paris Peace Settlements-Changes in the map of Europe; critical evaluation of the Treaty of Versailles.

8. The Great Depression

(i) Causes leading to the Wall Street Crash of 1929 and its impact on the economy of USA, Germany & Japan.

(ii) Roosevelt and the New Deal – (a) Aims (b) Measures taken.

9. Rise of Communism under Stalin in Russia (1928-1939)

(i) Rise of Stalin to power and factors assisting his rise.

(ii) Main features of Stalin's domestic policy:

Collectivisation of agriculture.
Industrialisation: First and Second Five Year Plans
Purges of 1937-1938.

10. Rise of Fascism under Mussolini in Italy (1919-39)

(i) Post-War discontent and the rise to power of Benito Mussolini.

Conditions which gave rise to Fascism; a brief chronological account of the events which brought Mussolini to power from the election of 1921 to the march on Rome in October 1922.

(ii) Main features of Mussolini's domestic policy.

Critical appraisal of Mussolini's policies particularly his economic policy.

11. Rise of Nazism under Hitler in Germany (1933-39)

(i) Rise of Hitler to power and factors assisting his rise.

Weaknesses of the Weimar Republic as a background to the rise of Nazism; events from 1932 onwards leading to Hitler becoming Chancellor of Germany in 1933; the reasons for his popularity among different groups should be explained.

(ii) The Nazi State: from 1933 onwards.

Outline of the changes made by Hitler in government, the cultural life and education,

army (the Night of the Long Knives), the economy and religious life. Escalation of the campaign against the Jews should be done in some detail, till the "Final Solution". Reasons why his policies were accepted among different groups.

12. Rise of Militarism in Japan (1919-37)

Reasons for the rise of militarism in the 1930s.

PAPER II (PROJECT WORK)
- 20 MARKS

Candidates will be required to undertake **one** project on any one of the following history topics from 18th-20th centuries (India/World).

1. Politics – leadership, domestic policy, foreign policy.
2. Military – any war: causes, course and consequences. Strategies & tactics. Technology. Outcome: peace settlements.
3. Economy – economic policy: terms and impact. Currency, communication, trade. Agriculture and industry.
4. Society & culture – Traditions, food, clothing, festivals, role and status of women, education, art, architecture, sculpture, music, dance, literature.
5. Religion – philosophy, ideas, beliefs, practices, impact.

The project **may** be in any one of the following categories:

1. A case study.
2. A field visit/ investigation.
3. A local history.
4. Interview/oral evidence.
5. Book review/ film review/ posters/ newspapers/ advertisements/ cartoons and art.

The project may or may not be based on the syllabus; students must be encouraged to produce original, creative and insightful perspectives on an allied aspect of the topic.

The written outcome of the project, in the form of 800–1500-word essay should be structured as given below:

- Introduction - Background and context to be discussed very briefly.
- Main body - Explanation, Interpretation, Analysis and Critical Evaluation of a range of evidence: the research material gathered by the student.
- Conclusion - Brief summing up of the topic.
- Bibliography – a list of all material referred to in the essay, including print, electronic, oral & audio-visual material, referenced correctly, in a standard format.
- Appendix – optional, only if it is crucial for the better understanding of the project essay.

List of Suggested Projects

1. Leaders- political, social, cultural, religious, military
2. Growth of political organizations in the 18th - early 20th centuries.
3. Impact of British colonial policies before/ after 1857.
4. Industrialisation - Impact on the lives of the people.
5. Birth of totalitarian ideologies.
6. The 1920s Cultural Movement in USA - Jazz Age.
7. Changes in nature of warfare – late 19th and early 20th century conflicts, World War I.
8. Growth of feminist movements in the West.
9. Music/art as a medium of protest.
10. Books that changed the course of history.

EVALUATION CRITERIA:

Mark allocation for the Project will be as follows:

Assessment objective	Criteria	Marks
1. Process	Candidates should be able to: Identify the topic, Plan and detail a research project.	5
2. Understanding, application of knowledge and Analysis	Candidates should be able to: Explain issues and themes clearly and in context. Interpret, analyse and evaluate critically the topic.	5
3. Presentation	Overall format and referencing	5
4. Viva	Range of questions based on the project only.	5
TOTAL		**20**

GUIDELINES FOR TEACHERS:

1. It must be emphasized that the **process** of doing the project is as important as the finished product.
2. Once the project/projects are chosen, there should be a process of brainstorming to encourage students to make out a draft/structure for the project before embarking on research.
3. During the brainstorming/discussion, the teacher should discuss the assessment criteria with the students.
4. The teacher should discuss the draft with the student with regard to the central question and the type of sources to be used.
5. The students should be guided on doing the research and looking at different types of evidence.
6. Books and suitable reference materials could be suggested and even put up on the library notice board for guidance of the students.
7. Internet sites could be suggested, but care must be taken in selecting, using and citing these sites.
8. Students must be cautioned against plagiarism and be penalized for the same.
9. Marks must be awarded for content and originality and not for decorative elements and embellishments.
10. Projects must be the original work of the students.

CLASS XII

*There will be **two** papers in the subject:*

Paper I: Theory 3 hours ------ 80 marks

Paper II: Project Work --------20 marks

PAPER I (THEORY) – 80 Marks

SECTION A

INDIAN HISTORY

1. Towards Independence and Partition: The Last Phase (1939-1947)

(i) National Movement during the Second World War:

Reasons behind the August Offer and the Cripps Mission. The proposals and the reasons for their rejection leading directly to the Quit India Resolution. A compact account of the movement, its suppression and a brief analysis of its significance.

(ii) Subhash Chandra Bose and the INA.

Bose's organisation of the INA, a brief account of its operations, eventual defeat and significance.

(iii) Transfer of power (1945-1947):

Reasons for change in the attitude of the British government after World War II.

Cabinet Mission: its aims and major provisions.

1947: Attlee's Declaration of 20th February 1947; Mountbatten Plan – main features: reasons for acceptance of the Plan by major political parties.

Modifications in the Indian Independence Act.

2. Establishment of Indian democracy (1947 – 1966)

The following should be discussed:

(i) The role of Sardar Patel in the reorganization and integration of princely states.

(ii) Problems of integrating Junagarh, Hyderabad and Kashmir.

(iii) First general election (1952): problems of preparation and their solutions, process, result and impact of the elections.

(iv) The linguistic reorganization of states: Features of the States Reorganisation Act, 1956 with particular reference to Andhra, Bombay and Punjab.

3. Development of Indian Democracy (1964 – 1977)

The following to be discussed:

(i) Lal Bahadur Shastri – his contributions as Prime Minister

(ii) Importance of the election of 1967

(iii) Main Opposition political parties and their ideologies – Socialist Party (SP); Communist Party of India (CPI); Communist Party of India (Marxist (CPI(M)); Bharatiya Jan Sangh; Shiromani Akali Dal.

(iv) Naxal Movement: factors of its rise; main leaders (Charu Majumdar and Kanu Sanyal); areas where they operated (West Bengal and Andhra Pradesh) and the struggle carried out by peasants and students.; government measures against it; reasons for its decline in the 1970's and its impact.

(v) JP Movement (1974-75): Origin: Jai Prakash Narayan's disputes with Mrs. Gandhi; main features of its course. Assessment of its significance.

(vi) Emergency (1975-76): reasons for imposition; main features of the suspension of democratic rights. Assessment of its impact (positive and negative aspects).

4. Changing face of the Indian Democracy (1977 – 1986)

(i) The Janata Government (1977 – 1979).

Elections of 1977: establishment of the Janata Government; its policies and their implementation; reasons for its downfall.

(ii) Centre-State relations

(a) Punjab: Demands of the Akali Dal; Anandpur Sahib Resolution; 1977 elections; formation of Akali government; rise of Bhindranwale – his demands and methods.

Centre's response: Operation Bluestar – its results and impact. Punjab Accord, 1985.

(b) Assam: Reasons for Assamese discontent; course of Assam's agitation; the Centre's response: Assam Accord, 1985.

(c) Nagaland: The Nagas' separatist demands; birth of Nagaland state; course of the agitation; Shillong Accord, 1975.

(d) Mizoram:
Mizoram Movement (1959-1986): course and resolution.

5. India's Foreign Policy

(i) Pakistan (1947-49, 1965, 1971)

Indo-Pak wars: causes, course and consequences of each to be done separately.

(ii) Sino-Indian War (1962)

Disputes with the Peoples' Republic of China over (a) Tibet issue: Chinese takeover and asylum of the Dalai Lama in India; (b) Border issues.
Sino-Indian War (1962): immediate causes and consequences.

6. Movements for Women's Rights

Towards Equality Report (1974) - aims, significance and recommendations.

Developments in the anti-dowry movement and struggle against domestic violence in the 1970s and 1980s.

Measures undertaken by the government in response.

SECTION B

WORLD HISTORY

7. World War II

(i) Factors leading to the War: aggressive foreign policies of Germany, Italy and Japan.

Should be discussed to show how these aggressive policies made war more likely and worldwide in scope.

(ii) Anglo-French appeasement policies.

Appeasement: why Britain and France chose to follow this policy and how it was carried out.

(iii) Course of the invasion by the Axis powers in Europe and Asia (1939-1941).

(iv) Reasons for the defeat of the Axis Powers.

8. De-colonisation – in Asia (China) and Africa (Ghana & Kenya)

(i) China:

A short background of the problems facing the Communists in 1949: in agriculture, the gradual process from land distribution to collective farms should be outlined; in industry, the Five Year Plan and Soviet help.

The Great Leap Forward should be covered in more detail, particularly the development of commune and assessment of the GLF.

(ii) Ghana: democracy and dictatorship (1957-66).

Brief background to independence, Nkrumah's role, reasons for his overthrow.

(iii) Kenya: conflict and independence (1947 – 1964).

Conflict with whites over independence and role of Kenyatta.

9. Cold War (1945-91)– origin, end and impact

(i) Origins of the Cold War: End of wartime unity; Yalta and Potsdam Conferences; Truman Doctrine and Marshall Plan; Molotov Plan, COMECON and Cominform.

(ii) Breakup of the USSR & changes in Eastern Europe – USSR, Germany and Poland.

Reasons for collapse of USSR

Political changes; Coup of 1991; Demand for independence by the Soviet republics leading to the breakup of USSR.

Fall of communism in East Europe in the following countries: Poland and Germany.

10. Protest Movements

Civil Rights Movement, anti-Apartheid Movement; Feminist Movement.

(i) Racial problems and civil rights in USA in the 1950s, 1960s and 1970s: Racial discrimination, change in the government's

attitude, campaign for equal rights (Dr. Martin Luther King's role).

(ii) Anti-Apartheid Movement in South Africa (1948-1994): main features of Apartheid, opposition to Apartheid (Dr Nelson Mandela's role), transition to black majority rule and the end of Apartheid.

(iii) Second Wave Feminist Movement in USA (early 1960s – early 1980's): reasons for its origin (the impact of the Presidential Commission, Betty Friedan's book and the Civil Rights Movement; Equal Pay Act of 1963 – its implications for American women, successive measures taken by Johnson (Civil Rights Act of 1964), role of National Organisation for Women (NOW) and its campaign for the Equal Rights Amendment (ERA).

11. Middle East: Israeli-Palestine conflict (1916-1993)

(i) Post War conflict in Palestine after World War I, till the formation of the state of Israel.

Aims of Arab nationalism and Zionism. Impact of World War I: the conflicting promises made by the British to the Arabs and the Jews: Husain-MacMahon correspondence, the Sykes-Picot Agreement and the Balfour Declaration.

(ii) The Arab-Israeli Wars from 1948 to Camp David Accord (1979).

The following conflicts should be studied – First Arab- Israeli Conflict (1948-1949), the Suez Crisis (1956), the Six Day War (1967), the Yom Kippur War (1973), Sadat and the Camp David Accord (1979).

For each of these events, the causes and results should be studied in detail.

The origin and formation of the PLO.

(iii) Oslo Peace Accords (1993).

Intifada and the change in attitude of Israel and the PLO leading to the Oslo Peace Accords: assessment of the main features: why it failed to bring peace.

PAPER II (PROJECT WORK) - 20 MARKS

Candidates will be required to undertake **one** project on any one of the following history topics from the 20th-21st (till 2012) centuries (India/World).

6. Politics – leadership, domestic policy, foreign policy.
7. Military – any war: causes, course and consequences. Strategies & tactics. Technology. Outcome: peace settlements.
8. Economy – economic policy: terms and impact. Currency, communication, trade. Agriculture and industry.
9. Society & culture – Traditions, food, clothing, festivals, role and status of women, education, art, architecture, sculpture, music, dance, literature.
10. Religion – philosophy, ideas, beliefs, practices, impact.

The project **may** be in any one of the following categories:

1. A case study.
2. A field visit/ investigation.
3. A local history.
4. Interview/oral evidence.
5. Book review/ film review/ posters/ newspapers/ advertisements/ cartoons and art.

The project may or may not be based on the syllabus; students must be encouraged to produce original, creative and insightful perspectives on an allied aspect of the topic.

The written outcome of the project, in the form of 800–1500-word essay, should be structured as given below:

- Introduction - Background and context to be discussed very briefly.
- Main body - Explanation, Interpretation, Analysis and Critical Evaluation of a range of evidence: the research material gathered by the student.
- Conclusion - Brief summing up of the topic.
- Bibliography – a list of all material referred to in the essay, including print, electronic, oral & audio-visual material, referenced correctly, in a standard format.
- Appendix – optional, only if it is crucial for the better understanding of the project essay.

List of suggested Projects:

1. Leaders – e.g., Malcolm X, Rosa Parks, Noor Inayat Khan, Surya Sen, Vinoba Bhave, Sun Yat Sen, Golda Meir, Sirimavo Bandaranaike, Margaret Thatcher, etc.
2. Radical organisations – ideologies, acts and impact. E.g., KKK, Al Qaeda, Boko Haram, Al-Shabaab, Sendero Luminoso, Khmer Rouge, Japanese Red Army, etc.
3. Protests Movements – political ideologies, civil rights, workers, caste, environment. E.g., Arab Spring, Chipko Movement, Black Lives Matter, Dalit Panther Movement, etc.
4. UN – Peacekeeping actions and Weaknesses.
5. Regional Organizations and their contributions – E.g., SAARC, ASEAN, EU, AU, etc.
6. Growth of feminist movements in India /the West.
7. Music /art as a medium of protest.
8. Books that have had a profound effect on society.
9. Wars – e.g., contribution of Indian soldiers to the World Wars; role of colonial armies in the World Wars; guerrilla wars (e.g. Vietnam War), etc.

The Project will be assessed by the teacher and a Visiting Examiner appointed locally and approved by the Council.

Assessment of Project Work will be done as follows:

1.	Internal Evaluation by Teacher	10 Marks
2.	Evaluation by Visiting Examiner	10 Marks
	TOTAL	**20 Marks**

Internal Evaluation by the Teacher:

S.no.	Assessment objective	Criteria	Marks
1.	Process	Candidate should be able to: Identify the topic. Plan and detail a research project.	3
2.	Understanding, application of knowledge and Analysis	Candidate should be able to: Explain issues and themes clearly and in context. Interpret, analyse and evaluate critically the topic.	4
3.	Presentation	Overall format and referencing, title page and bibliography.	3
TOTAL			**10**

Evaluation by the Visiting Examiner:

S.no.	Assessment objective	Criteria	Marks
1.	Choice of Technique/ Detailed procedure & Presentation	Overall format, referencing, title page and bibliography.	4
2.	Analysis and evaluation	Candidates should be able to: Interpret, analyze and evaluate critically a range of evidence.	3
3.	Viva	Range of questions based on the project only.	3
TOTAL			**10**

GUIDELINES FOR TEACHERS:

1. It must be emphasized that the **process** of doing the project is as important as the finished product.
2. Once the project/projects are chosen, there should be a process of brainstorming to encourage students to make out a draft/structure for the project before embarking on research.
3. During the brainstorming/discussion, the teacher should discuss the assessment criteria with the students.
4. The teacher should discuss the draft with the student with regard to the central question and the type of sources to be used.
5. The students should be guided on doing the research and looking at different types of evidence.
6. Books and suitable reference materials could be suggested and even put up on the library notice board for guidance of the students.
7. Internet sites could be suggested, but care must be taken in selecting, using and citing these sites.
8. Students must be cautioned against plagiarism and be penalized for the same.
9. Marks must be awarded for content and originality and not for decorative elements and embellishments.
10. Projects must be the original work of the student.

GEOGRAPHY (853)

Aims

1. To enable candidates to acquire knowledge (information) and to develop an understanding of facts, terms, symbols concepts, principles, generalizations, hypotheses, problems, trends, processes and methods of Geography at the national and global level.
2. To apply the knowledge of the principles of Physical Geography in explaining the causes and consequences of natural hazards and suggest ways of coping with them through sustainable development.
3. To develop skills of drawing maps, surveying, and drawing statistical diagrams and thematic maps.
4. To develop an interest in Geography.

CLASS XI

*There will be **two** papers in the subject:*

***Paper I** – Theory (3 hours) ....70 marks*

***Paper II** – Practical and Project Work ...30 marks*

PAPER I: THEORY (70 Marks)

GEOGRAPHY AS A DISCIPLINE

1. Geography - its interdisciplinary approach and future prospects (not to be tested).

Geography as an integrating discipline. Physical Geography and Natural Sciences; Geography and Social Sciences.

Branches of Geography:

(i) *Systematic approach: Physical Geography (Geomorphology, Climatology, Hydrology); Human Geography (Historical, Social, Population and Settlement, Economic, Political).*

- *The conceptual and intellectual ideas of a number of new approaches to contemporary human geography should be examined to understand the strengths and limitations of each approach within the context of Human Geography and Social Sciences.*

(ii) *Regional approach: Regional/ Area Studies, Regional Planning, Regional Development.*

Future prospects of Geography to be discussed:

- *In the area of GPS, GIS, Remote Sensing for resource identification.*
- *Applied geography in town and country planning, environment management and law, cartography and mapping, geography education, map analysis, travel and tourism (to be taught only for the sake of awareness, not for testing).*

PRINCIPLES OF PHYSICAL GEOGRAPHY

2. Formation of the Earth

Theories of formation; Methods of measuring age of the earth; Structure and Composition; Rocks.

(i) *Theories of formation of the earth: the Big Bang theory; Planetesimal and Nebular hypothesis.*

(ii) *Methods of measuring age of the earth: Radioactivity – a brief understanding.*

(iii) *Structure and composition of the earth's interior: crust, mantle, core; their properties - temperature, pressure, thickness. Sources of information – direct and indirect; seismic waves, their behaviour and inferences, the causes of earthquakes and distribution: effects; isoseismal and homoseismal lines, measuring earthquakes and their intensity.*

Case study of earthquakes on a country like Nepal.

Vulcanicity-materials and processes; major volcanic forms.

Explanation of how volcanoes are formed; identification of the type of volcano; recognition of the properties of volcanic materials; explanation of why volcanoes are more in the areas of converging plates.

(iv) *Rocks: The mineral groups responsible for different rocks formed on the earth: silicates, carbonates, sulphides, metals.*

Classification of rocks by origin: igneous, metamorphic and sedimentary rocks – their distribution in India; characteristics, types, economic importance.

The rock cycle.

3. Changing Face of the Earth

Landforms and Processes of Gradation

(i) Endogenous processes: theory of plate tectonics and the process of drifting continents, theory of Isostasy by Pratt and A. Holmes.

Definition of endogenetic force, difference between slow and sudden forces, vertical and horizontal forces and their effects. Folding and Faulting – types, Sea floor spreading, continental drifting and isostasy.

(ii) Landforms – mountains, plateaus and plains and their types.

Meaning and differentiation between the three main landforms of the earth.

Classification of mountains on the basis of their origin or mode of formation: fold, block, volcanic and residual with examples from the world.

Classification of plateaus on the basis of their situation: intermontane, piedmont and continental with examples from the world.

Classification of Plains on the basis of formation: depositional with examples from the world.

(iii) Exogenetic process and associated landforms.

Weathering and gradation – difference between the two. Role of weathering in gradation. Different types of weathering.

(iv) Fluvial processes and associated landforms.

Work of rivers - concept of baselevel; processes of erosion, transportation and deposition. Types of erosion - headward, vertical, lateral; transportation mode and deposition.

Landforms made by the river - V shaped valley, gorges, waterfalls, levees, floodplains, meanders; braided channels, oxbow lakes, deltas – delta plains.

Diagrams and examples from India with photographs.

(v) Aeolian processes and associated landforms.

Process of wind erosion – abrasion, attrition, deflation. Ideal conditions for erosion in hot deserts; landforms resulting from erosion - deflation hollows, pedestal rocks, yardangs, desert pavement; landforms resulting from deposition - sand dunes and their types, loess. Diagrams and examples from India with photographs.

(vi) Glacial processes and associated landforms.

Continental and mountain or valley glaciers, processes of glacial erosion – plucking, abrasion, attrition; erosional features, e.g. cirque, depositional formations, moraines of various types. Diagrams and examples from India with photographs.

(vii) Work of ground water and associated landforms.

Process of erosion by groundwater solution, corrasion. Features formed by underground water (karst topography), depositional features – stalactites, stalagmites. Diagrams and examples from India with photographs.

(viii) Marine processes and associated landforms.

Erosional features; sea cliffs, sea caves, sea arch, headland inlet, stacks and depositional landforms, e.g. - bays, bars and lagoons. Diagrams and examples from India.

4. Atmosphere

(i) Composition and structure of atmosphere.

Layers of the atmosphere: troposphere, stratosphere, ozonosphere, mesosphere, ionosphere; their height; composition; special characteristics of each layer; ozone depletion.

(ii) Atmospheric temperature.

Heating and cooling of the atmosphere, radiation, advection, conduction, convection. Insolation and factors influencing it – angle of sun's rays, duration of day, transparency of atmosphere. Heat budget i.e. balance between insolation and terrestrial radiation-

areas of surplus and deficit heat in different latitudes resulting in latitudinal heat balance.

Factors controlling its horizontal and vertical distribution, temperature anomalies and their nature. Isotherms: their characteristics. Reasons for the variations in temperature.

Practical work on temperature measurement and graphs to show variations in temperature of one or more cities of India.

(iii) Atmospheric Pressure.

Its horizontal and vertical distribution, factors affecting the distribution, characteristics of isobars.

Pressure belts and winds – types of winds, air masses and atmospheric disturbances, cyclones of temperate and tropical areas; anticyclones.

(iv) Atmospheric Moisture.

Processes of evaporation, condensation and precipitation; relative and absolute humidity; forms of condensation - cloud, fog, dew, frost; precipitation – its forms: snow, hail, rain; types of rainfall: orographic, cyclonic, convectional.

(v) Climate change- causes/factors of climatic changes in the recent past.

Natural and man-made factors, with special reference to climatic changes in India. Measures taken to adapt to these changes in urban and rural India.

Practical work on measuring rainfall and use of bar graphs to show variations in rainfall in one or more cities of India.

5. The Realms of Water

(i) Submarine relief of the Atlantic, Pacific and Indian Oceans.

The depth and the features. The sea floor deposits and their characteristics, the importance of marine resources. Ocean pollution and ways to overcome them.

(ii) Ocean water - salinity, temperature, density.

Composition of seawater and factors that control distribution of salinity, density and temperature.

(iii) Ocean water movements.

Direct and indirect tides – origin, time, spring and neap tides. Waves – parts, characteristics, formation. Currents - factors affecting currents, currents of Indian, Pacific and Atlantic oceans. Role of currents in modifying climates of coastal areas. Introduction to El Nino and La Nina as conditions that affect the intensity of the monsoons over India.

6. Biosphere – Life on the Earth

(i) Nature of Biosphere, concept of ecosystems, components of ecosystem.

Meaning, nature of interaction between the different components of the biosphere. Understanding the concept of biodiversity. To appreciate various reasons for valuing and conserving biodiversity (ethical, moral, economic, aesthetic).

(ii) Biodiversity for sustenance of mankind.

The various roles played by biodiversity in sustaining mankind - as a source of food, medicine, pollution control, etc.

(iii) India as a mega diversity nation.

A basic understanding that India with its varied climate and landscape is home to a variety of unique ecosystems and endemic species e.g. the largest mangrove forest in the world - the Sundarbans, vast mountain forests in the Himalayas, tropical evergreen forests in the Western Ghats and the North-East region, desert vegetation in Rajasthan, thorn and scrub forests in the plateaus, etc.

(iv) Strategies for conservation of biodiversity – in-situ and ex-situ.

Understanding the implications of loss of biodiversity;

Looking at various in-situ and ex-situ strategies for their efficacy and viability;

In-situ strategies - protected areas (biosphere reserves, national parks, wildlife sanctuaries).

Ex-situ strategies - captive breeding, zoo, botanical garden, gene banks and their use.

7. Map Work

A question on map work will be set to identify, label and locate any of the following items studied in topics from **Principles of Physical Geography**.

MAP LIST

Mountains (To mark and label):

Himalayas, Hindukush, Elburz, Zagros, Kirthar, Caucasus, Alps, Pyrenees, Carpathians, Urals, Khingan, Kunlun, Drakensburg, Kjolen, Andes, Rockies, Appalachian, Great Dividing Range.

Plateaus (To mark and label): *Tibetan, West Australian, Iranian, Anatolian, Pamirs, Ethiopian, Deccan, Guiana, Brazilian, Arabian.*

Water Bodies (bays, gulfs, straits, sea, oceans) (To mark and label): *Arctic Ocean, Atlantic Ocean, Indian Ocean, Pacific Ocean, Southern Ocean, Hudson bay, Gulf of Mexico, Bering Sea, Sea of Japan, South China Sea, Yellow Sea, Timor Sea, Persian Gulf, Red Sea, Black Sea, Mediterranean Sea, Caspian Sea, Arabian Sea, North Sea, Suez Canal, Strait of Magellan, Bay of Bengal.*

Rivers (To identify): *Mississippi, Amazon, Parana, Orange, Nile, Zaire, Rhine, Danube, Volga, Euphrates, Tigris, Ob, Yenisei, Lena, Hwang Ho, Yangtze Kiang, Irrawaddy, Ganga, Murray, Darling.*

Ocean Currents (To identify): *North Atlantic Drift, Gulf Stream, Labrador current, Peru current, West wind drift, Southwest Monsoon current, West Australian current, KuroShio current, Oyashio current, East Australian current.*

Islands (To identify): *Greenland, Hawaii, West Indies, Tierra del Fuego, Baffin, Newfoundland, Iceland, Madagascar, Sri Lanka, Philippines, Papua New Guinea, Indonesia, Japan, New Zealand.*

PAPER II: PRACTICAL WORK AND PROJECT WORK (30 Marks)

Candidates will be required to undertake the following Practical work and Project work:

1. Practical Work

Any ***two*** of the following four topics to be undertaken.

(a) Surveying - elementary principles; preparing plans of the school compound or a small area with the help of chain and tape.

(b) Statistical diagrams - line graphs (simple and multiple), composite bars, pie diagram, flow and star diagram, (the data used will be that used in Paper I).

(c) Map projections – uses, construction and properties of the following:

(i) Cylindrical equal area.

(ii) Simple conical with one standard parallel.

(iii)Zenithal equidistant.

(d) Aerial photographs – Introduction; definition; difference between map and an aerial photographs; uses of aerial photographs, advantages of aerial photography.

Types of Aerial Photographs:

(i) *Based on the position of the cameral axis – vertical photographs, low oblique, high oblique (only definition and explanation).*

(ii) *Based on Scale – (a) Large scale photographs (b) Small scale photographs. Scale of Aerial Photograph – (a) by establishing of relationship between photo distance and ground distance; (b) by establishing relationship between photo distance and map distance.*

2. Project Work (Assignment)

One topic as an assignment. Sketches and drawings will be given credit).

(i) Take any physical feature in your immediate locality:

(a) draw sketches or take photograhs to highlight physical features.

(b) survey how these features have been used and prepare a report.

(c) suggest ways by which the area of study could be better used keeping in view the needs of the people of the region.

(ii) Choose any island area of the world or India and:

(a) trace the map of the area and show physical features, towns and port cities.

(b) prepare a project report using photographs and pictures from brochures and magazines to show:

- its origin and formation.
- soil types, vegetation.
- human occupations.

(iii) Any natural hazard like drought, flood, erosion, landslides, etc. in a local area.

Choose a natural hazard in the local area. Describe the nature of damage by consulting newspaper reports, studies, interviews with local people. Identify the nature of damage before and after – land, building, public property, soil, vegetation, animals, etc. What are the chances of it occuring again and what precautions are being taken?

(iv) World Climatic types

Low latitude/tropical climates:

(a) Equatorial (b) Monsoon and trade wind littoral (c) Dry tropical (desert).

Mid latitude/temperature climates:

(a) Medditerranean (b) Marine west coast (c) Dry sub-tropical (d) Dry mid latitude (cold deserts).

High latitude/polar climates –

(a) Borreal (b) Tundra

For each of the above climatic types, the following is to be studied:

- *Location, climatic conditions and areas;*
- *Description of major human activities (both farming and forestry).*

CLASS XII

*There will be **two** papers in the subject:*

***Paper I** – Theory (3 hours) ...70 marks*

***Paper II** – Practical and Project Work ...30 marks*

PAPER I: THEORY (70 Marks)

INDIA IN THE WORLD'S CONTEXT

1. Physical Environment

(i) Locational setting - India: size and area. Present importance of the location of India with reference to the Indian Ocean Rim countries.

Extent, position with reference to latitude and longitude, length of coastline and frontiers with neighbouring countries. The locational advantages of India in the Indian Ocean and as a subcontinent.

(ii) Structure of India – Geological formation, relief and drainage; major physiographic divisions and their characteristics.

(a) Outline of the geological evolution and structure:

Names of the main Standard and Indian geological eras with reference to Indian Geology.

Geological evolution of: the Peninsular Plateau, the Himalayas and the Great Plains. Difference between the Peninsular Plateau and the Himalayas.

(b) The five-fold physiographic divisions: the Himalayan Mountain complex, the Indus-Ganga-Brahmaputra Plains, the Peninsular Plateau, Coastal plains and the Islands of India.

- ***Himalayan mountain complex: (orthoclinal structure)***

  The three parallel ranges, the northwest and northeast offshoots, comparison between Western and Eastern Himalayas.

  Regional divisions of the Himalayas (Kashmir/ Punjab Himalayas, Himachal/ Uttaranchal/ Kumaon Himalayas, Nepal Himalayas, Assam Himalayas).

- ***Indus-Ganga-Brahmaputra Plains***

  The relief features – bhabar, tarai, bhangar, khadar, doabs. Regional divisions of the plains: Rajasthan plain (the Great Indian desert), Punjab plain, Ganga plain, Brahamaputra/ Assam plain.).

- ***The Peninsular Plateau***

  The Malwa plateau, Chotanagpur Plateau and Deccan Plateau: the relief features - badland, Western Ghats, Eastern Ghats, Aravalis. Comparison between the Western Ghats and the Eastern Ghats.

- ***Coastal Plains***

  Comparison between Western and Eastern Coastal Plains and their divisions. The relief features: Lagoons, deltas.

- ***Islands***

  Difference between Andaman and Nicobar and Lakshadweep islands.

  The above five physical divisions are to be studied with reference to their extent, altitude, slope and landform characteristics.

(c) Drainage (i.e. rivers) and drainage systems: Names and sources of the main rivers (Ganga, Yamuna, Indus, Sutlej, Brahmaputra, Mahanandi, Godavari, Kaveri, Krishna, Narmada, Tapi).

Comparison of Himalayan and Peninsular rivers.

(iii) Climate: India - Factors affecting India's climate: Temperature - factors affecting temperature. Atmospheric pressure conditions during the year; origin and mechanism of the monsoon, Jet streams, Southern Oscillations; wind and rainfall distribution during the year; characteristics of the four main seasons - hot and dry, hot and

wet, cool and dry, cool and wet with reference to temperature distribution in north and south India, pressure, wind conditions – distribution of resultant rainfall; variability of rainfall, incidence of droughts and floods. Temperature and rainfall graphs of Mumbai, Delhi, Chennai, Jaisalmer and Leh.

Role of various factors affecting Indian climate – latitudinal extent, distance from the sea, northern mountain ranges, physiography, monsoon winds, upper air circulation, western disturbances and tropical cyclones, southern oscillation, El Nino; understanding of the concept and mechanism of monsoon; Indian Monsoonal Regime – onset, rain bearing system, break in the monsoon, retreat of the monsoon;

Seasons of India – with reference to temperature, pressure distribution, wind systems and local winds (loo, kalbaisaki/ Norwesters, Mango showers; explanation of the variability of rainfall in different areas over different seasons.

Droughts and Floods – meaning, causes, affected areas and mitigation programmes. Temperature and rainfall graphs of Mumbai, Delhi, Chennai, Leh and Jaisalmer.

(iv) Natural vegetation:

Forest – area covered, importance, use, misuse and potential both for exploitation and conservation. Present forest policy.

Importance of forest to man; Impact of human activity on vegetation. Forest area and forest cover in India. Forest Conservation – need, Social Forestry (Agro forestry, community forestry, commercial farm forestry, non-commercial farm forestry, urban forestry); Forest Conservation Movement: Van Mahotsav, Chipko Movement.

National Forest Policy (1988): objectives of the Forest Policy.

2. Population and Human settlements

(i) Population of India

*Population of India with reference to percentage **of world population** and India's position in the world.*

(ii) National and State level patterns of population distribution.

Definition of census. Index of concentration (highest and lowest index of concentration as per the latest census), density of population – arithmetic and physiological.

Spatial distribution of population in India and explanation of the factors influencing it – landforms, climate, accessibility and level of development that result in this pattern. Comparison of the density at the State level and factors influencing it.

(iii) Pattern of population growth in the last three decades; implications for development.

Meaning of terminologies such as population, birth rate, death rate, population growth rate, natural growth rate and migratory growth.

Population growth of India at national level – trends of 1921, 1951 and 1981 to the latest Census. Demographic characteristics of India at the National level- birth rate, death rate, and natural growth rate from 1991 to the latest Census.

Drawing general conclusions about the:

Impact of rapid growth rate on economic development, on environment; need for planned development (to maintain the ecological balance).

(iv) Migration trends over the last 25 years.

Explanation of the important terms – step-wise migration and migrant, push and pull factors.

Types (National and International migration, inter migration and intra migration.

Streams of migration: (rural-rural, rural-urban, urban-urban and urban-rural).

Causes for migration - natural, economic, political and social.

(v) Demographic attributes at National level - trends and patterns of: 1. Rural urban population 2. Age and sex composition 3. Literacy levels 4. Working and non-working population; implications for development.

Study of the causes and trends of rural urban composition, age and sex ratio, literacy level, working and non-working population at the National level (highest and lowest figures for each of the above) in the latest census. Implications for development.

(vi) Rural settlements –Types and patterns in hill areas, plains and coastal locations.

Distinction between Rural and Urban settlements; Rural and Urban Population.

Factors affecting the types (distinction between compact and dispersed) and patterns (linear, circular, star shaped, rectangular, shapeless) of rural settlements in plains, coastal areas, mountains and plateau areas.

(vii) Urban settlements – size, classification of towns as per the latest census.

Definition of an Urban area according to the latest census; Urban agglomeration, conurbation, urban sprawl, slums.

Factors that influence the growth of urban centres in India. Problems and advantages of urban growth.

3. Resources of India and their Utilisation

(i) Need for environmental management vis-à-vis development.

Understanding that from the development point of view, environment may mistakenly be seen as a 'resource' to be exploited, whereas, environment needs to be viewed as a 'capital' that needs to be managed carefully.

(ii) Land resources**:** Land use pattern in India – quality of cultivable land, size of land holdings.

Defining the term land resource; its importance and problems. Land use pattern – net sown area, area sown more than once, land not available for cultivation, permanent pastures and other grazing lands, culturable (cultivable) waste, fallow land, quality and size of cultivable land holdings. Methods to reduce fragmentation of land holdings.

(iii) Water resources and types of irrigation.

Water Resources: Their demand and utilization. Types of water resources: surface and ground water.

Meaning, importance and need for irrigation in India.

Sources of irrigation:

Modern methods: sprinkler irrigation, drip irrigation, Perennial canals - Advantages and disadvantages.

Use and misuse of water for irrigation. Overwatering - reasons and regions affected by it; dangers of overwatering;

Conservation of water resources including their management; rain water harvesting.

(iv) Agriculture: Types, development and problems.

(a) Wet and dry farming, crop rotation, intensity of cropping, problems of Indian agriculture; use of technology in agriculture. Modern inputs, change over from subsistence to commercial agriculture, need for Green Revolution**.** Diversifying Indian agriculture – importance of animal husbandry.

Wet and dry agriculture: Crop rotation. Intensity of cropping – concept and crops associated; problems of Indian agriculture; Use of new technology – Green revolution: Need, second green revolution - its strategies. Diversification of Indian agriculture – Animal Husbandry: meaning and its importance in Indian Agriculture.

(b) Study of crops:

(i) Conditions of growth (soil, temperature, rainfall requirements, crop seasons.

(ii) Major producing States in India of the following crops:

Food grains – Rice, Wheat, Coarse grains – Sorghum (Jowar) , Pennisetum

(Bajra or Camboo), Eleusine (Ragi), Pulses.

Commercial and Industrial crops – Coffee, Tea, Cotton, Sugarcane, Jute, Groundnut, Coconut.

Conditions of growth: For each crop, the type of soil, temperature range, rainfall range, the crop seasons are to be done.

Main areas of growth of the above crops and reasons for growth are to be studied.

Name of the leading States in India for each of the above crops (Food grains, commercial and industrial crops).

Importance of Market Gardening and Orchard Farming – reasons and trends in development in recent years.

Self-explanatory

(v) Fishing in India

Methods, factors affecting the importance and development, major fishing areas, need and methods of fish conservation.

Understanding of marine and inland fisheries; deep sea and inshore fishing; pelagic and demersal fishing. Problems affecting fishing in India.

Two fishing states (Andhra Pradesh and Kerala) in India should be studied and factors affecting the development of fishing in the given areas.

(vi) Sources of Energy

(a) Minerals and power resources.

Distinguishing between metallic and non-metallic minerals; ferrous and non-ferrous minerals.

Production and distribution (one leading State and one leading centre in each State) of Iron ore, mica, coal and petroleum; their uses. Factors affecting the exploitation of mineral resources, effects of mining on the national economy.

The main power resources – Nuclear, thermal, hydel. Factors influencing its development.

Any three centres for generation of nuclear power in India.

(b) Conventional energy sources - fossil fuels, potential in industrialisation (Indian context) and limitations of each source, methods of harnessing and environmental consequences of their use.

Conventional energy sources:

Coal, Petroleum-their potential in industrialisation and limitations in India. Environmental concerns with regard to their use (global warming, thermal pollution in waters, fly ash, atmospheric pollution, etc.).

(c) Non-conventional energy sources - types of non-conventional sources (bio-mass, solar, wind, tidal, geothermal), potential (Indian context); their environmental consequences; need to promote non-conventional energy sources.

Advantages and limitations of each non-conventional energy source.

Understanding the need to promote non-conventional energy sources.

4. Infrastructural Resources (Development of Transport and Communication).

(a) Railways, Roadways, Water transport (inland and coastal), Air transport, Pipelines - these modes of transport are to be studied with regard to –

Factors that govern their distribution, density and growth.

The present position, areas well and poorly served by each mode.

Problems and advantage of each mode of transport, national goals to be achieved in the development of modes of transport (The Golden quadrilateral - its north-south and east-west corridor).

The major trading Ports (Mumbai, Chennai, Kolkata, Kochi), their location and advantage; major exports and imports of different ports and factors affecting the nature and direction of trade from the ports.

International trading patterns and products in the last five years.

Distinguishing between harbour and port; natural and artificial harbours. Location of major ports in India (Mumbai, Chennai, Kolkata , Kochi) and their advantage; main items of export and import from different ports and the factors affecting the nature and direction of trade from the ports. International trading patterns in the last five years.

(b) Communication – importance of communication in rural and urban development and its policy. Importance of infrastructure as key to the development of an industrial economy.

Modern means of communication - satellites and remote sensing - Geographic Information Systems (GIS), cellular phones, radio, doordarshan, internet; difference between mass communication and tele communication.

5. Industries

(a) Study of the location and distribution of important industrial centres; a general comparison of disparities.

Self-explanatory.

(b) Major industrial regions – factors governing their growth.

Reasons for the spread of industrial areas; Understand how the distribution of heavy and consumer industries varies in the different regions; Understanding why certain industries are more in a particular region.

Major Industrial regions: Mumbai-Pune, Hooghly, Bengaluru-Tamil Nadu, Gujarat, Chota Nagpur, Vishakhapatnam-Guntur, Gurgaon-Delhi-Meerut.

Factors governing the growth of the above to be studied.

(c) Location, production and growth of the following industries:

(i) **Agro based industries** – Sugar, cotton textile

Sugar Industry:

Maharashtra (Ahmednagar and Pune), Uttar Pradesh (Muzaffarnagar and Saharanpur),

Cotton Textiles:

Maharashtra (Mumbai and Pune), Gujarat (Ahmedabad and Surat).

(ii) **Mineral based industries** – Iron and steel, Petrochemicals, including refineries.

The following industrial centres of each industry are to be studied.

Iron and Steel:

TISCO (Jamshedpur), Vishweshvarya Iron and Steel Plant (Bhadravati), Bhilai Iron and Steel Plant (Bhilai), Rourkela Iron and Steel Plant (Rourkela), Hindustan Steel Limited Plant (Durgapur), Bokaro Iron and Steel Plant (Bokaro), Salem Iron and Steel Plant (Salem), Vishakhapatnam Iron and Steel Plant (Vishakhapatnam).

(Integrated and mini steel plants: meaning, advantages and disadvantages also to be studied.)

Petro Chemicals:

UDEX (Koyali), IPCL (Vadodara).

Oil refineries:

IOCL (Barauni, Haldia and Digboi), HPCL (Mumbai and Vishakhapatnam).

NOTE: Factors responsible for the location, development and present status of the Agro and Mineral based industries mentioned above, as well as the distribution centres are to be studied.

Difference between key and footloose industry; industrial clusters and indices to identify industrial clusters.

Maps and sketches of Industrial regions and centres (location of agro based and mineral based industries) should be the basis for explaining the pattern of industrial development.

(d) Tourism industry – Major natural and cultural tourist areas in India. Their special features and level of development - impact on environment and local economy. Tourist flows.

Definition of tourism, growth of tourism, advantages of tourism, important places – both natural and cultural. Positive and negative impact of tourism, problems of tourism and measures for developing eco-tourism.

6. Regional Economic Development

(Case studies)

Case studies will be preceded by a brief understanding of the meaning of development, multilevel planning and planning regions. These case studies will be undertaken with reference to the advantages and disadvantages that have accrued to the people and area - aspects covered will be their geographical location, resource base, developmental history, agriculture and industrial activities, issues of development.

1. Area development in Chhattisgarh region – mining, silk industry and farming.
2. Electronics industry in Bengaluru– reasons for its development, extent, national and international linkages and problems.
3. Growth of Haldia port, its industries and hinterland.

7. Map Work

A question on map work will be set to identify, label and locate any of the following items studied in topics 1-6.

MAP LIST:

Locational setting of India (To identify):

$8^0$4'N-$37^0$6'N, $68^0$7'E- $97^0$25'E (Latitudinal and longitudinal extent of India); $23^0$30' N (Central latitude) and $82^0$30'E (Central longitude); Indira Col and Cape Comorin (Northern and Southern point of mainland India).

Mountains (To mark and label):

3 parallel ranges of Himalayas (Greater, Lesser, Outer), Trans Himalayan range – Karakoram, Aravallis, Vindhyas, Satpura, Western and Eastern Ghats, Nilgiris, Cardamom hills, Garo, Khasi, Jaintia hills, Patkoi hills, Naga hills, Mizo hills.

Plains (To mark and label):

Indus-Ganga-Brahmapurtra region, Konkan, Kanara, Malabar, Coromandel, Northern Circars.

Plateaus (To mark and label):

Malwa, Chota Nagpur, Deccan, Meghalaya.

Peninsula (To mark and label):

Kathiawar, Kachchh.

Lakes (To mark and label):

Chilika, Pulicat.

Waterbodies (To mark and label):

Arabian Sea, Bay of Bengal, Palk Strait, Gulf of Kachchh, Gulf of Khambat,

Passes (To mark and label) :

Karakoram, Shipki La, Nathu La, Bomdi La, Palghat, Bhorghat, Thalghat.

Rivers (To identify) :

Indus, Jhelum, Chenab, Ravi, Beas, Sutlej, Ganga, Yamuna, Gomti, Ghaghara, Gandak, Kosi, Chambal, Betwa, Ken, Son, Damodar, Luni, Narmada, Tapi, Mahanadi, Godavari, Krishna, Kaveri, Brahmaputra.

Population (To identify):

The States of India (according to the latest Census) for the following: The Lowest density of population, highest density of population, highest level of urbanization, lowest level of urbanisation, highest Index of Concentration of population, the highest sex ratio, the lowest sex ratio, the highest literacy, the lowest literacy;

Urban cities of Delhi, Mumbai, Chennai and Kolkata, Bengaluru, Ahmedabad.

Agriculture (To identify):

Main producing States/regions of India for: Rice, Wheat, Coffee, Tea, Cotton, Jute, Sugarcane, Groundnut, Coconut.

Power resources (To identify):

Nuclear Power Stations (Kaiga, Kalpakkam, Tarapur, Rawatbhata, Narora, Kakrapara),

Industries (To identify):

Sugar Industry: Ahmednagar, Pune

Cotton Textiles: Mumbai, Ahmedabad, Surat

Iron and Steel: TISCO(Jamshedpur), Bhilai Iron and Steel Plant (Bhilai), Vishakhapatnam Iron and Steel Plant (Vishakhapatnam).

Petro Chemicals: UDEX (Koyali) and IPCL (Vadodara);

Oil refineries: IOCL (Digboi, Barauni and Haldia);

Transport (To identify):

Trace the route of: Golden Quadrilateral - 4 sides, North South Corridor, East West Corridor; State with the Highest Density of roads.

Ports (To identify):

Mumbai, Kochi, Haldia, Chennai, Kolkata.

SKETCH MAPS

Candidates should be able to draw, label, understand and interpret the sketch maps related to the following topics:

- *Locational setting of India;*
- *Relief of India;*
- *Climate;*
- *Population;*
- *Industries;*
- *Transport*

PAPER II: PRACTICAL WORK AND PROJECT WORK (30 Marks)

Candidates will be required to undertake the following Practical work and Project work .

1. Practical Work:

Any ***two*** of the following topics to be undertaken:

(i) Drawing of scales: linear, graphic scales showing primary and secondary divisions; representative fractions and statement of scale methods.

(ii) Drawing of cross-section or profiles of important contours, viz. ridge, plateau, escarpment, valley, conical hill, types of slope, sea cliffs, waterfalls, spurs, by using vertical exaggeration and horizontal equivalent.

(iii) Understanding and illustrating location references of SOI maps.

(iv) Map reading and interpretation of survey of India maps: Study will be based on representative portions of any **two** topographical sheets. It will include the description of location, extent, relief features, drainage, land use, settlement patterns, communications and inferences about human occupations and stage of economic development of the area.

(v) Introduction to Geographic Information System: Elements of visual interpretation of remote sensing maps/ images.

Colour significance in the image and true colour (false colour composition): texture; size; shape; shadow; association.

(Reference material – Wikipedia, Google. earth, IIRS Hyderabad).

(vi) Elementary principles of surveying an area: preparing two plans of school compound and/or a small area using Plane table/ GPS.

2. Project Work (Assignment):

Local field surveys on any ***one*** of the following will be submitted as Project Report. These surveys should be organized with a table of contents, sample taken and statistical methods used, interview schedule. The report should be organized systematically, and the conclusions should be clearly stated.

(i) Agricultural land use survey.

Choose a district or topographical map of an area 1: 250000 and make a sketch map showing land use; compare the patterns of these. Alternatively, a local village could be chosen and the fields mapped from the cadastral map with information on the crops grown in different seasons and the location of the village, its roads and landmarks, if any.

(ii) Household survey of about 30-60 households of a village or locality.

Family size, age structure, educational background, occupation, involvement of men and women in economic activity, educational service. Draw conclusions to reflect the economic development of the households.

(iii) Amenity study.

Study of hospitals in a city, schools (school where you studied), post offices, municipal zones within the city (blocks in a village study) – reasons for travel (based on the

importance and demand for the place), travel time, travel distance, mapping the hinterland of the service.

(iv) Study of a manufacturing industry or a self-employed person.

Visit a manufacturing unit or self-employed person – cycle or car repair shop, small fabricating unit, factory if nearby and find out – source of raw material, supply routes, final product, areas where it is sent, manpower strength and their organization.

(v) Area development of a multipurpose river valley project – impact on the region.

Self-explanatory.

The Practical Work and the Project Work will be assessed by the teacher and a Visiting Examiner appointed locally and approved by the Council. No question paper for practical work and project work will be set by the Council.

Evaluation of Practical Work and Project Work will be as follows:

Practical file (Sessional Record):	10 marks
Assignment (Project Report):	10 marks
Viva voce:	10 marks

MATHEMATICS (860)

CLASS XI

*There will be **two** papers in the subject:*

***Paper I :** Theory (3 hours) ……80 marks*

***Paper II:** Project Work ……20 marks*

PAPER I (THEORY) – 80 Marks

*The syllabus is divided into **three** sections A, B and C.*

*Section A is compulsory for all candidates. Candidates will have a choice of attempting questions from **EITHER** Section B **OR** Section C.*

DISTRIBUTION OF MARKS FOR THE THEORY PAPER

S.No.	UNIT	TOTAL WEIGHTAGE
SECTION A: 65 Marks		
1.	Sets and Functions	20 Marks
2.	Algebra	24 Marks
3.	Coordinate Geometry	8 Marks
4.	Calculus	6 Marks
5.	Statistics & Probability	7 Marks
SECTION B: 15 marks		
6.	Conic Section	7 Marks
7.	Introduction to Three-Dimensional Geometry	5 Marks
8.	Mathematical Reasoning	3 Marks
OR **SECTION C: 15 Marks**		
9.	Statistics	5 Marks
10.	Correlation Analysis	4 Marks
11.	Index Numbers & Moving Averages	6 Marks
	TOTAL	**80 Marks**

SECTION A

1. Sets and Functions

(i) Sets

Sets and their representations. Empty set. Finite and Infinite sets. Equal sets. Subsets. Subsets of a set of real numbers especially intervals (with notations). Power set. Universal set. Venn diagrams. Union and Intersection of sets. Difference of sets. Complement of a set. Properties of Complement of Sets.

(ii) Relations & Functions

Ordered pairs, Cartesian product of sets. Number of elements in the cartesian product of two finite sets. Cartesian product of the set of reals with itself (upto R x R x R). Definition of relation, pictorial diagrams, domain, co-domain and range of a relation. Function as a special type of relation. Function as a type of mapping, domain, co-domain and range of a function. Real valued functions, domain and range of these functions, constant, identity, polynomial, rational, modulus, signum, exponential, logarithmic and greatest integer functions. Sum, difference, product and quotient of functions.

- ***Sets****: Self-explanatory.*
- ***Basic concepts of Relations and Functions***
  - *Ordered pairs, sets of ordered pairs.*
  - *Cartesian Product (Cross) of two sets, cardinal number of a cross product.*

    Relations as:
  - *an association between two sets.*
  - *a subset of a Cross Product.*
  - *Domain, Range and Co-domain of a Relation.*
  - *Functions:*
  - *As special relations, concept of writing "y is a function of x" as y = f(x).*
  - *Domain and range of a function.*

(iii) Trigonometry

Positive and negative angles. Measuring angles in radians and in degrees and conversion from one measure to another. Definition of trigonometric functions with the help of unit circle. Truth of the identity $\sin^2x+\cos^2x=1$, for all x. Signs of trigonometric functions. Domain and range of trignometric functions and their graphs. Expressing sin (x±y) and cos (x±y) in terms of sinx, siny, cosx & cosy and their simple applications. Deducing the identities like the following:

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \tan y},$$

$$\cot(x \pm y) = \frac{\cot x \cot y \mp 1}{\cot y \pm \cot x}$$

$$\sin\alpha \pm \sin\beta = 2\sin\frac{1}{2}(\alpha \pm \beta)\cos\frac{1}{2}(\alpha \mp \beta)$$

$$\cos\alpha + \cos\beta = 2\cos\frac{1}{2}(\alpha + \beta)\cos\frac{1}{2}(\alpha - \beta)$$

$$\cos\alpha - \cos\beta = -2\sin\frac{1}{2}(\alpha + \beta)\sin\frac{1}{2}(\alpha - \beta)$$

Identities related to sin 2x, cos2x, tan 2x, sin3x, cos3x and tan3x.

- ***Angles and Arc lengths***
  - *Angles: Convention of sign of angles.*
  - *Magnitude of an angle: Measures of Angles; Circular measure.*
  - *The relation $S = r\theta$ where θ is in radians. Relation between radians and degree.*
  - *Definition of trigonometric functions with the help of unit circle.*
  - *Truth of the identity $\sin^2x+\cos^2x=1$*

  NOTE: *Questions on the area of a sector of a circle are required to be covered.*
- ***Trigonometric Functions***
  - *Relationship between trigonometric functions.*
  - *Proving simple identities.*

- *Signs of trigonometric functions.*
- *Domain and range of the trigonometric functions.*
- *Trigonometric functions of all angles.*
- *Periods of trigonometric functions.*
- *Graphs of simple trigonometric functions (only sketches).*

NOTE: *Graphs of sin x, cos x, tan x, sec x, cosec x and cot x are to be included.*

- ***Compound and multiple angles***
  - *Addition and subtraction formula: $\sin(A \pm B)$; $\cos(A \pm B)$; $\tan(A \pm B)$; $\tan(A + B + C)$ etc., Double angle, triple angle, half angle and one third angle formula as special cases.*
  - *Sum and differences as products $\sin C + \sin D = 2\sin\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$, etc.*
  - *Product to sum or difference i.e. $2\sin A\cos B = \sin(A + B) + \sin(A - B)$ etc.*

2. Algebra

(i) Complex Numbers

Introduction of complex numbers and their representation, Algebraic properties of complex numbers. Argand plane and polar representation of complex numbers. Square root of a complex number. Cube root of unity.

- *Conjugate, modulus and argument of complex numbers and their properties.*
- *Sum, difference, product and quotient of two complex numbers additive and multiplicative inverse of a complex number.*
- *Square root of a complex number.*
- *Cube roots of unity and their properties.*

(ii) Quadratic Equations

Statement of Fundamental Theorem of Algebra, solution of quadratic equations (with real coefficients).

- *Use of the formula:*

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

In solving quadratic equations.

- *Equations reducible to quadratic form.*
- *Nature of roots*
  - *Product and sum of roots.*
  - *Roots are rational, irrational, equal, reciprocal, one square of the other.*
  - *Complex roots.*
  - *Framing quadratic equations with given roots.*

NOTE: *Questions on equations having common roots are to be covered.*

- ***Quadratic Functions.***

  Given α, β as roots then find the equation whose roots are of the form α^3, β^3, etc.

  Case I: $a > 0$ → *Real roots*, *Complex roots*, *Equal roots*

  Case II: $a < 0$ → *Real roots*, *Complex roots, Equal roots*

  Where 'a' is the coefficient of x^2 in the equations of the form $ax^2 + bx + c = 0$.

- ***Sign of quadratic***

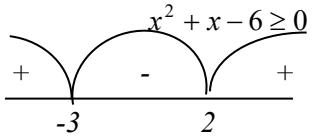
  Sign when the roots are real and when they are complex.

- ***Inequalities***
  - Linear Inequalities

    Algebraic solutions of linear inequalities in one variable and their representation on the number line.

    Self-explanatory.
  - Quadratic Inequalities

    Using method of intervals for solving problems of the type:



A perfect square e.g. $x^2 - 6x + 9 \geq 0$.

- *Inequalities involving rational expression of type*

$$\frac{f(x)}{g(x)} \leq a \text{ . etc. to be covered.}$$

(iii) Permutations and Combinations

Fundamental principle of counting. Factorial n. (n!) Permutations and combinations, derivation of formulae for ${}^nP_r$ and ${}^nC_r$ and their connections, simple application.

- *Factorial notation n! , n! =n (n-1)!*
- *Fundamental principle of counting.*
- *Permutations*
  - ${}^nP_r$.
  - *Restricted permutation.*
  - *Certain things always occur together.*
  - *Certain things never occur.*
  - *Formation of numbers with digits.*
  - *Word building - repeated letters - No letters repeated.*
  - *Permutation of alike things.*
  - *Permutation of Repeated things.*
  - *Circular permutation – clockwise counterclockwise – Distinguishable / not distinguishable.*
- *Combinations*
  - ${}^nC_r$, ${}^nC_n$ =1, ${}^nC_0$ = 1, ${}^nC_r = {}^nC_{n-r}$, ${}^nC_x = {}^nC_y$, *then* $x + y = n$ *or* $x = y$, ${}^{n+1}C_r = {}^nC_{r-1} + {}^nC_r$.
  - *When all things are different.*
  - *When all things are not different.*
  - *Mixed problems on permutation and combinations.*

(iv) Binomial Theorem

History, statement and proof of the binomial theorem for positive integral indices. Pascal's triangle, General and middle term in binomial expansion, simple applications.

- *Significance of Pascal's triangle.*
- *Binomial theorem (proof using induction) for positive integral powers,*

  i.e. $(x + y)^n = {}^nC_0x^n + {}^nC_1x^{n-1}y + \ldots\ldots + {}^nC_ny^n$.

Questions based on the above.

(v) Sequence and Series

Sequence and Series. Arithmetic Progression (A.P.). Arithmetic Mean (A.M.) Geometric Progression (G.P.), general term of a G.P., sum of first *n* terms of a G.P., infinite G.P. and its sum, geometric mean (G.M.), relation between A.M. and G.M. Formulae for the following special sums $\sum n, \sum n^2, \sum n^3$.

- *Arithmetic Progression (A.P.)*
  - $T_n = a + (n - 1)d$
  - $S_n = \frac{n}{2}\{2a + (n-1)d\}$
  - *Arithmetic mean:* $2b = a + c$
  - *Inserting two or more arithmetic means between any two numbers.*
  - *Three terms in A.P. :* $a - d, a, a + d$
  - *Four terms in A.P.:* $a - 3d, a - d, \quad a + d, a + 3d$
- *Geometric Progression (G.P.)*

  $T_n = ar^{n-1}$, $S_n = \frac{a(r^n - 1)}{r - 1}$,

  - $S_\infty = \frac{a}{1-r}; |r| < 1$ *Geometric Mean,* $b = \sqrt{ac}$
  - *Inserting two or more Geometric Means between any two numbers.*
  - *Three terms are in G.P.* ar, a, ar^{-1}
  - *Four terms are in GP* $ar^3, ar, ar^{-1}, ar^{-3}$
- *Special sums* $\sum n, \sum n^2, \sum n^3$

  Using these summations to sum up other related expression.

3. Coordinate Geometry

(i) Straight Lines

Brief recall of two-dimensional geometry from earlier classes. Shifting of origin. Slope

of a line and angle between two lines. Various forms of equations of a line: parallel to axis, point-slope form, slope-intercept form, two-point form, intercept form and normal form. General equation of a line. Equation of family of lines passing through the point of intersection of two lines. Distance of a point from a line.

- *Basic concepts of Points and their coordinates.*
- *The straight line*
  - *Slope or gradient of a line.*
  - *Angle between two lines.*
  - *Condition of perpendicularity and parallelism.*
  - *Various forms of equation of lines.*
  - *Slope intercept form.*
  - *Two-point slope form.*
  - *Intercept form.*
  - *Perpendicular /normal form.*
  - *General equation of a line.*
  - *Distance of a point from a line.*
  - *Distance between parallel lines.*
  - *Equation of lines bisecting the angle between two lines.*
  - *Equation of family of lines*
  - *Definition of a locus.*
  - *Equation of a locus.*

(ii) Circles

- *Equations of a circle in:*
  - *Standard form.*
  - *Diameter form.*
  - *General form.*
  - *Parametric form.*
- *Given the equation of a circle, to find the centre and the radius.*
- *Finding the equation of a circle.*
  - *Given three non collinear points.*
  - *Given other sufficient data for example centre is (h, k) and it lies on a line and two points on the circle are given, etc.*

4. Calculus

Limits and Derivatives

Derivative introduced as rate of change both as that of distance function and geometrically.

Intuitive idea of limit. Limits of polynomials and rational functions trigonometric, exponential and logarithmic functions. Definition of derivative relate it to scope of tangent of the curve, Derivative of sum, difference, product and quotient of functions. Derivatives of polynomial and trigonometric functions.

- *Limits*
  - *Notion and meaning of limits.*
  - *Fundamental theorems on limits (statement only).*
  - *Limits of algebraic and trigonometric functions.*

NOTE: *Indeterminate forms are to be introduced while calculating limits.*

- *Differentiation*
  - *Meaning and geometrical interpretation of derivative.*
  - *Derivatives of simple algebraic and trigonometric functions and their formulae.*
  - *Differentiation using first principles.*
  - *Derivatives of sum/difference.*
  - *Derivatives of product of functions. Derivatives of quotients of functions.*

5. Statistics and Probability

(i) Statistics

Measures of dispersion: range, mean deviation, variance and standard deviation of ungrouped/grouped data.

- *Mean deviation about mean.*
- *Standard deviation - by direct method, short cut method and step deviation method.*

NOTE: *Mean, Median and Mode of grouped and ungrouped data are required to be covered.*

(ii) Probability

Random experiments; outcomes, sample spaces (set representation). Events; occurrence of events, 'not', 'and' and 'or' events, exhaustive events, mutually exclusive

events, Axiomatic (set theoretic) probability, connections with other theories studied in earlier classes. Probability of an event, probability of 'not', 'and' and 'or' events.

- *Random experiments and their outcomes.*
- *Events: sure events, impossible events, mutually exclusive and exhaustive events.*
  - *Definition of probability of an event*
  - *Laws of probability addition theorem.*

SECTION B

6. Conic Section

Sections of a cone, ellipse, parabola, hyperbola, a point, a straight line and a pair of intersecting lines as a degenerated case of a conic section. Standard equations and simple properties of parabola, ellipse and hyperbola.

- *Conics* a*s a section of a cone.*
  - *Definition of Foci, Directrix, Latus Rectum.*
  - *PS = ePL where P is a point on the conics, S is the focus, PL is the perpendicular distance of the point from the directrix.*

(i) Parabola

e =1, $y^2 = \pm 4ax$, $x^2 = 4ay$, $y^2 = -4ax$, $x^2 = -4ay$.

- *Rough sketch of the above.*
- *The latus rectum; quadrants they lie in; coordinates of focus and vertex; and equations of directrix and the axis.*
- *Finding equation of Parabola when Foci and directrix are given, etc.*
- *Application questions based on the above.*

(ii) Ellipse

- $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, $e<1$, $b^2 = a^2(1-e^2)$
- *Cases when $a > b$ and $a < b$.*
- *Rough sketch of the above.*
- *Major axis, minor axis; latus rectum; coordinates of vertices, focus and centre; and equations of directrices and the axes.*
- *Finding equation of ellipse when focus and directrix are given.*
- *Simple and direct questions based on the above.*
- *Focal property i.e. SP + SP′ = 2a.*

(iii) Hyperbola

- $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, $e>1$, $b^2 = a^2(e^2-1)$
- *Cases when coefficient y^2 is negative and coefficient of x^2 is negative.*
- *Rough sketch of the above.*
- *Focal property i.e. SP - S'P = 2a.*
- *Transverse and Conjugate axes; Latus rectum; coordinates of vertices, foci and centre; and equations of the directrices and the axes.*

7. Introduction to three-dimensional Geometry

Coordinate axes and coordinate planes in three dimensions. Coordinates of a point. Distance between two points and section formula.

- *As an extension of 2-D*
- *Distance formula.*
- *Section and midpoint form*

8. Mathematical Reasoning

Mathematically acceptable statements. Connecting words/ phrases - consolidating the understanding of "if and only if (necessary and sufficient) condition", "implies", "and/or", "implied by", "and", "or", "there exists" and their use through variety of examples related to the Mathematics and real life. Validating the statements involving the connecting words, Difference between contradiction, converse and contrapositive.

Self-explanatory.

SECTION C

9. Statistics

- *Combined mean and standard deviation.*
- *The Median, Quartiles and Mode of grouped and ungrouped data.*

10. Correlation Analysis

- *Definition and meaning of covariance.*
- *Coefficient of Correlation by Karl Pearson. If $x-\bar{x}$, $y-\bar{y}$ are small non-fractional numbers, we use*

$$r = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sqrt{\sum(x-\bar{x})^2}\sqrt{\sum(y-\bar{y})^2}}$$

If x and y are small numbers, we use

$$r = \frac{\sum xy - \frac{1}{N}\sum x \sum y}{\sqrt{\sum x^2 - \frac{1}{N}(\sum x)^2}\sqrt{\sum y^2 - \frac{1}{N}(\sum y)^2}}$$

Otherwise, we use assumed means A and B, where u = x-A, v = y-B

$$r = \frac{\sum uv - \frac{1}{N}(\sum u)(\sum v)}{\sqrt{\sum u^2 - \frac{1}{N}(\sum u)^2}\sqrt{\sum v^2 - \frac{1}{N}(\sum v)^2}}$$

11. Index Numbers and Moving Averages

(i) Index Numbers

- *Price index or price relative.*
- *Simple aggregate method.*
- *Weighted aggregate method.*
- *Simple average of price relatives.*
- *Weighted average of price relatives (cost of living index, consumer price index).*

(ii) Moving Averages

- *Meaning and purpose of the moving averages.*
- *Calculation of moving averages with the given periodicity and plotting them on a graph.*
- *If the period is even, then the centered moving average is to be found out and plotted.*

PAPER II – PROJECT WORK – 20 Marks

Candidates will be expected to have completed **two** projects, one from Section A and one from ***either*** Section B **or** Section C.

Mark allocation for **each** Project [10 marks]:

Overall format	1 mark
Content	4 marks
Findings	2 marks
Viva-voce based on the Project	3 marks
Total	**10 marks**

List of suggested assignments for Project Work:

Section A

1. Using a Venn diagram, find the number of subsets of a given set and verify that if a set has 'n' number of elements, the total number of subsets is 2^n .
2. Verify that for two sets A and B, $n(A \times B) = pq$, where $n(A) = p$ and $n(B) = q$, the total number of relations from A to B is 2^{pq}.
3. Using Venn diagram, verify the distributive law for three given non-empty sets A, B and C.
4. Identify distinction between a relation and a function with suitable examples and illustrate graphically.
5. Establish the relationship between the measure of an angle in degrees and in radians with suitable examples by drawing a rough sketch.
6. Illustrate with the help of a model, the values of sine and cosine functions for different angles which are multiples of $\pi/2$ and π.
7. Draw the graphs of sin x, sin 2x, 2 sin x, and sin x/2 on the same graph using same coordinate axes and interpret the same.

8. Draw the graph of cos x, cos 2x, 2 cos x, and cos x/2 on the same graph using same coordinate axes and interpret the same.
9. Using argand plane, interpret geometrically, the meaning of $i = \sqrt{-1}$ and its integral powers.
10. Draw the graph of quadratic function $f(x) = ax^2 + bx + c$. From the graph find maximum/minimum value of the function. Also determine the sign of the expression.
11. Construct a Pascal's triangle to write a binomial expansion for a given positive integral exponent.
12. Obtain a formula for the sum of the squares/sum of cubes of 'n' natural numbers.
13. Obtain the equation of the straight line in the normal form, for α (the angle between the perpendicular to the line from the origin and the x-axis) for each of the following, on the same graph:
    (i) $\alpha < 90°$
    (ii) $90° < \alpha < 180°$
    (iii) $180° < \alpha < 270°$
    (iv) $270° < \alpha < 360°$
14. Identify the variability and consistency of two sets of statistical data using the concept of coefficient of variation.
15. Construct the tree structure of the outcomes of a random experiment, when elementary events are not equally likely. Also construct a sample space by taking a suitable example.

Section B

16. Construct different types of conics by PowerPoint Presentation, or by making a model, using the concept of double cone and a plane.
17. Use focal property of ellipse to construct ellipse.
18. Use focal property of hyperbola to construct hyperbola.
19. Write geometrical significance of X coordinate, Y coordinate, and Z coordinate in space. Using the above, find the distance of the point in space from x-axis/y-axis/z-axis. Explain the above using a three-dimensional model/ power point presentation.
20. Obtain truth values of compound statements of the type $p \wedge q$ by using switch connection in series.
21. Obtain truth values of compound statements of the type $p \vee q$ by using switch connection in parallel.

Section C

22. Explain the statistical significance of percentile and draw inferences of percentile for a given data.
23. Find median from the point of intersection of cumulative frequency curves (less than and more than cumulative frequency curves).
24. Describe the limitations of Spearman's rank correlation coefficient and illustrate with suitable examples.
25. Identify the purchasing power using the concept of cost of living index number.
26. Identify the purchasing power using the concept of weighted aggregate price index number.
27. Calculate moving averages with the given even Periodicity. Plot them and as well as the original data on the same graph.

MATHEMATICS (860)

CLASS XII

*There will be **two** papers in the subject:*

***Paper I :** Theory (3 hours) ……80 marks*

***Paper II:** Project Work ……20 marks*

PAPER I (THEORY) – 80 Marks

*The syllabus is divided into **three** sections A, B and C.*

*Section A is compulsory for all candidates. Candidates will have a choice of attempting questions from **EITHER** Section B **OR** Section C.*

DISTRIBUTION OF MARKS FOR THE THEORY PAPER

S.No.	UNIT	TOTAL WEIGHTAGE
SECTION A: 65 MARKS		
1.	Relations and Functions	10 Marks
2.	Algebra	10 Marks
3.	Calculus	32 Marks
4.	Probability	13 Marks
SECTION B: 15 MARKS		
5.	Vectors	5 Marks
6.	Three - Dimensional Geometry	6 Marks
7.	Applications of Integrals	4 Marks
OR **SECTION C: 15 MARKS**		
8.	Application of Calculus	5 Marks
9.	Linear Regression	6 Marks
10.	Linear Programming	4 Marks
TOTAL		**80 Marks**

SECTION A

1. Relations and Functions

(i) Types of relations: reflexive, symmetric, transitive and equivalence relations. One to one and onto functions, composite functions, inverse of a function. Binary operations.

- *Relations as:*
  - *Relation on a set A*
  - *Identity relation, empty relation, universal relation.*
  - *Types of Relations: reflexive, symmetric, transitive and equivalence relation.*
- *Binary Operation: all axioms and properties*
- *Functions:*
  - *As special relations, concept of writing "y is a function of x" as y = f(x).*
  - *Types: one to one, many to one, into, onto.*
  - *Real Valued function.*
  - *Domain and range of a function.*
  - *Conditions of invertibility.*
  - *Composite functions and invertible functions (algebraic functions only).*

(ii) Inverse Trigonometric Functions

Definition, domain, range, principal value branch. Graphs of inverse trigonometric functions. Elementary properties of inverse trigonometric functions.

- *Principal values.*
- *$\sin^{-1}x$, $\cos^{-1}x$, $\tan^{-1}x$ etc. and their graphs.*
- *$\sin^{-1}x = \cos^{-1}\sqrt{1-x^2} = \tan^{-1}\dfrac{x}{\sqrt{1-x^2}}$.*
- *$\sin^{-1}x = \operatorname{cosec}^{-1}\dfrac{1}{x}$; $\sin^{-1}x + \cos^{-1}x = \dfrac{\pi}{2}$ and similar relations for $\cot^{-1}x$, $\tan^{-1}x$, etc.*

$$\sin^{-1}x \pm \sin^{-1}y = \sin^{-1}\left(x\sqrt{1-y^2} \pm y\sqrt{1-x^2}\right)$$

$$\cos^{-1}x \pm \cos^{-1}y = \cos^{-1}\left(xy \mp \sqrt{1-y^2}\sqrt{1-x^2}\right)$$

similarly $\tan^{-1}x + \tan^{-1}y = \tan^{-1}\dfrac{x+y}{1-xy}, xy < 1$

$$\tan^{-1}x - \tan^{-1}y = \tan^{-1}\frac{x-y}{1+xy}, xy > -1$$

- *Formulae for $2\sin^{-1}x$, $2\cos^{-1}x$, $2\tan^{-1}x$, $3\tan^{-1}x$ etc. and application of these formulae.*

2. Algebra

Matrices and Determinants

(i) Matrices

Concept, notation, order, equality, types of matrices, zero and identity matrix, transpose of a matrix, symmetric and skew symmetric matrices. Operation on matrices: Addition and multiplication and multiplication with a scalar. Simple properties of addition, multiplication and scalar multiplication. Non-commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (restrict to square matrices of order upto 3). Concept of elementary row and column operations. Invertible matrices and proof of the uniqueness of inverse, if it exists (here all matrices will have real entries).

(ii) Determinants

Determinant of a square matrix (up to 3 x 3 matrices), properties of determinants, minors, co-factors and applications of determinants in finding the area of a triangle. Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equations by examples, solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.

- *Types of matrices ($m \times n$; $m, n \leq 3$), order; Identity matrix, Diagonal matrix.*
- *Symmetric, Skew symmetric.*

- *Operation – addition, subtraction, multiplication of a matrix with scalar, multiplication of two matrices (the compatibility).*

  E.g. $\begin{bmatrix}1 & 1\\ 0 & 2\\ 1 & 1\end{bmatrix}\begin{bmatrix}1 & 2\\ 2 & 2\end{bmatrix} = AB(say)$ *but BA is not possible.*

- *Singular and non-singular matrices.*
- *Existence of two non-zero matrices whose product is a zero matrix.*
- *Inverse (2×2, 3×3)* $A^{-1} = \dfrac{AdjA}{|A|}$

- *Martin's Rule (i.e. using matrices)*

  $a_1x + b_1y + c_1z = d_1$

  $a_2x + b_2y + c_2z = d_2$

  $a_3x + b_3y + c_3z = d_3$

  $$A = \begin{bmatrix}a_1 & b_1 & c_1\\ a_2 & b_2 & c_2\\ a_3 & b_3 & c_3\end{bmatrix} \quad B = \begin{bmatrix}d_1\\ d_2\\ d_3\end{bmatrix} \quad X = \begin{bmatrix}x\\ y\\ z\end{bmatrix}$$

  $AX = B \Rightarrow X = A^{-1}B$

  Problems based on above.

  NOTE 1: *The conditions for consistency of equations in two and three variables, using matrices, are to be covered.*

  NOTE 2: *Inverse of a matrix by elementary operations to be covered.*

- *Determinants*
  - *Order.*
  - *Minors.*
  - *Cofactors.*
  - *Expansion.*
  - *Applications of determinants in finding the area of triangle and collinearity.*
  - *Properties of determinants. Problems based on properties of determinants.*

3. Calculus

(i) Continuity, Differentiability and Differentiation. Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit functions. Concept of exponential and logarithmic functions.

Derivatives of logarithmic and exponential functions. Logarithmic differentiation, derivative of functions expressed in parametric forms. Second order derivatives. Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interpretation.

- *Continuity*
  - *Continuity of a function at a point x = a.*
  - *Continuity of a function in an interval.*
  - *Algebra of continues function.*
  - *Removable discontinuity.*
- *Differentiation*
  - *Concept of continuity and differentiability of* $|x|$*, [x], etc.*
  - *Derivatives of trigonometric functions.*
  - *Derivatives of exponential functions.*
  - *Derivatives of logarithmic functions.*
  - *Derivatives of inverse trigonometric functions - differentiation by means of substitution.*
  - *Derivatives of implicit functions and chain rule.*
  - *e for composite functions.*
  - *Derivatives of Parametric functions.*
  - *Differentiation of a function with respect to another function e.g. differentiation of* $\sin x^3$ *with respect to* x^3.
  - *Logarithmic Differentiation - Finding dy/dx when* $y = x^{x^{x^{\cdots}}}$.
  - *Successive differentiation up to* 2^{nd} *order.*

NOTE 1: *Derivatives of composite functions using chain rule.*

NOTE 2: *Derivatives of determinants to be covered.*

- *L' Hospital's theorem.*
  - $\frac{0}{0}$form, $\frac{\infty}{\infty}$form, 0^0 form, ∞^∞form *etc.*
- *Rolle's Mean Value Theorem - its geometrical interpretation.*
- *Lagrange's Mean Value Theorem - its geometrical interpretation*

(ii) Applications of Derivatives

Applications of derivatives: rate of change of bodies, increasing/decreasing functions, tangents and normals, use of derivatives in approximation, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (that illustrate basic principles and understanding of the subject as well as real-life situations).

- *Equation of Tangent and Normal*
- *Approximation.*
- *Rate measure.*
- *Increasing and decreasing functions.*
- *Maxima and minima.*
  - *Stationary/turning points.*
  - *Absolute maxima/minima*
  - *local maxima/minima*
  - *First derivatives test and second derivatives test*
  - *Point of inflexion.*
  - *Application problems based on maxima and minima.*

(iii) Integrals

Integration as inverse process of differentiation. Integration of a variety of functions by substitution, by partial fractions and by parts, Evaluation of simple integrals of the following types and problems based on them.

Definite integrals as a limit of a sum, Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals.

- *Indefinite integral*

- *Integration as the inverse of differentiation.*
- *Anti-derivatives of polynomials and functions $(ax+b)^n$, sinx, cosx, sec^2x, $cosec^2x$ etc .*
- *Integrals of the type sin^2x, sin^3x, sin^4x, cos^2x, cos^3x, cos^4x.*
- *Integration of 1/x, e^x.*
- *Integration by substitution.*
- *Integrals of the type $f'(x)[f(x)]^n$, $\frac{f'(x)}{f(x)}$.*
- *Integration of tanx, cotx, secx, cosecx.*
- *Integration by parts.*
- *Integration using partial fractions. Expressions of the form $\frac{f(x)}{g(x)}$ when degree of f(x) < degree of g(x)*

E.g. $$\frac{x+2}{(x-3)(x+1)}=\frac{A}{x-3}+\frac{B}{x+1}$$

$$\frac{x+2}{(x-2)(x-1)^2}=\frac{A}{x-1}+\frac{B}{(x-1)^2}+\frac{C}{x-2}$$

$$\frac{x+1}{(x^2+3)(x-1)}=\frac{Ax+B}{x^2+3}+\frac{C}{x-1}$$

When degree of f (x) ≥ degree of g(x),

e.g. $$\frac{x^2+1}{x^2+3x+2}=1-\left(\frac{3x+1}{x^2+3x+2}\right)$$

- *Integrals of the type:*

$$\int\frac{dx}{x^2\pm a^2},\int\frac{dx}{\sqrt{x^2\pm a^2}},\int\frac{px+q}{ax^2+bx+c}dx,\int\frac{px+q}{\sqrt{ax^2+bx+c}}dx$$

and $\int\sqrt{a^2\pm x^2}\ \mathrm{dx},\int\sqrt{x^2-a^2}\ \mathrm{dx},$

$\int \sqrt{ax^2+bx+c}\ \mathrm{dx}$, $\int (px+q)\sqrt{ax^2+bx+c}\ \mathrm{dx}$, *integrations reducible to the above forms.*

$\int \frac{dx}{a\cos x + b\sin x}$,

$\int \frac{dx}{a+b\cos x}, \int \frac{dx}{a+b\sin x} \int \frac{dx}{a\cos x + b\sin x + c}$,

$\int \frac{(a\cos x + b\sin x)dx}{c\cos x + d\sin x}$,

$\int \frac{dx}{a\cos^2 x + b\sin^2 x + c}$

$\int \frac{1 \pm x^2}{1+x^4}dx$,

$\int \frac{dx}{1+x^4}, \int \sqrt{\tan x}dx, \int \sqrt{\cot x}dx$ *etc.*

- *Definite Integral*
  - *Definite integral as a limit of the sum.*
  - *Fundamental theorem of calculus (without proof)*
  - *Properties of definite integrals.*
  - *Problems based on the following properties of definite integrals are to be covered.*

$$\int_a^b f(x)dx = \int_a^b f(t)dt$$

$$\int_a^b f(x)dx = -\int_b^a f(x)dx$$

$$\int_a^b f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$$

where $a < c < b$

$$\int_a^b f(x)dx = \int_a^b f(a+b-x)dx$$

$$\int_0^a f(x)dx = \int_0^a f(a-x)dx$$

$$\int_0^{2a} f(x)dx = \begin{cases} 2\int_0^a f(x)dx, if & f(2a-x) = f(x) \\ 0, & f(2a-x) = -f(x) \end{cases}$$

$$\int_{-a}^{a} f(x)dx = \begin{cases} 2\int_0^a f(x)dx, \text{if } f \text{ is an even function} \\ 0, \text{if } f \text{ is an odd function} \end{cases}$$

(iv) Differential Equations

Definition, order and degree, general and particular solutions of a differential equation. Formation of differential equation whose general solution is given. Solution of differential equations by method of separation of variables solutions of homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type: $\frac{dy}{dx}$+py= q, where p and q are functions of x or constants. $\frac{dx}{dy}$+ px = q, where p and q are functions of y or constants.

- *Differential equations, order and degree.*
- *Formation of differential equation by eliminating arbitrary constant(s).*
- *Solution of differential equations.*
- *Variable separable.*
- *Homogeneous equations.*
- *Linear form* $\frac{dy}{dx} + Py = Q$ *where P and Q are functions of x only. Similarly, for dx/dy.*
- *Solve problems of application on growth and decay.*
- *Solve problems on velocity, acceleration, distance and time.*
- *Solve population-based problems on application of differential equations.*
- *Solve problems of application on coordinate geometry.*

NOTE 1: *Equations reducible to variable separable type are included.*

NOTE 2: *The second order differential equations are excluded.*

4. Probability

Conditional probability, multiplication theorem on probability, independent events, total probability, Bayes' theorem, Random variable and its probability distribution, mean and variance of random variable. Repeated independent (Bernoulli) trials and Binomial distribution.

- *Independent and dependent events conditional events.*
- *Laws of Probability, addition theorem, multiplication theorem, conditional probability.*
- *Theorem of Total Probability.*
- *Baye's theorem.*
- *Theoretical probability distribution, probability distribution function; mean and variance of random variable, Repeated independent (Bernoulli trials), binomial distribution – its mean and variance.*

SECTION B

5. Vectors

Vectors and scalars, magnitude and direction of a vector. Direction cosines and direction ratios of a vector. Types of vectors (equal, unit, zero, parallel and collinear vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Definition, Geometrical Interpretation, properties and application of scalar (dot) product of vectors, vector (cross) product of vectors, scalar triple product of vectors.

- *As directed line segments.*
- *Magnitude and direction of a vector.*
- *Types: equal vectors, unit vectors, zero vector.*
- *Position vector.*
- *Components of a vector.*
- *Vectors in two and three dimensions.*
- $\hat{i}, \hat{j}, \hat{k}$ *as unit vectors along the x, y and the z axes; expressing a vector in terms of the unit vectors.*
- *Operations: Sum and Difference of vectors; scalar multiplication of a vector.*
- *Section formula.*
- *Triangle inequalities.*
- *Scalar (dot) product of vectors and its geometrical significance.*
- *Cross product - its properties - area of a triangle, area of parallelogram, collinear vectors.*
- *Scalar triple product - volume of a parallelepiped, co-planarity.*

NOTE: Proofs of geometrical theorems by using Vector algebra are excluded.

6. Three - dimensional Geometry

Direction cosines and direction ratios of a line joining two points. Cartesian equation and vector equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Angle between (i) two lines, (ii) two planes, (iii) a line and a plane. Distance of a point from a plane.

- *Equation of x-axis, y-axis, z axis and lines parallel to them.*
- *Equation of xy - plane, yz – plane, zx – plane.*
- *Direction cosines, direction ratios.*
- *Angle between two lines in terms of direction cosines /direction ratios.*
- *Condition for lines to be perpendicular/ parallel.*
- *Lines*
  - *Cartesian and vector equations of a line through one and two points.*
  - *Coplanar and skew lines.*
  - *Conditions for intersection of two lines.*
  - *Distance of a point from a line.*
  - *Shortest distance between two lines.*

NOTE: Symmetric and non-symmetric forms of lines are required to be covered.

- *Planes*
  - *Cartesian and vector equation of a plane.*
  - *Direction ratios of the normal to the plane.*
  - *One point form.*
  - *Normal form.*
  - *Intercept form.*
  - *Distance of a point from a plane.*
  - *Intersection of the line and plane.*
  - *Angle between two planes, a line and a plane.*
  - *Equation of a plane through the intersection of two planes i.e.* $P_1 + kP_2 = 0$.

7. Application of Integrals

Application in finding the area bounded b y simple curves and coordinate axes. Area enclosed between two curves.

- *Application of definite integrals - area bounded by curves, lines and coordinate axes is required to be covered.*
- *Simple curves: lines, circles/ parabolas/ ellipses, polynomial functions, modulus function, trigonometric function, exponential functions, logarithmic functions*

SECTION C

8. Application of Calculus

Application of Calculus in Commerce and Economics in the following:

- Cost function,
- average cost,
- marginal cost and its interpretation
- demand function,
- revenue function,
- marginal revenue function and its interpretation,
- Profit function and breakeven point.
- Rough sketching of the following curves: AR, MR, R, C, AC, MC and their mathematical interpretation using the concept of maxima & minima and increasing- decreasing functions.

Self-explanatory

NOTE: Application involving differentiation, integration, increasing and decreasing function and maxima and minima to be covered.

9. Linear Regression

- Lines of regression of x on y and y on x.
- Scatter diagrams
- The method of least squares.
- Lines of best fit.
- Regression coefficient of x on y and y on x.
- $b_{xy} \times b_{yx} = r^2$, $0 \le b_{xy} \times b_{yx} \le 1$
- Identification of regression equations
- Angle between regression line and properties of regression lines.
- Estimation of the value of one variable using the value of other variable from appropriate line of regression.

Self-explanatory

10. Linear Programming

Introduction, related terminology such as constraints, objective function, optimization, different types of linear programming (L.P.) problems, mathematical formulation of L.P. problems, graphical method of solution for problems in two variables, feasible and infeasible regions (bounded and unbounded), feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints).

Introduction, definition of related terminology such as constraints, objective function, optimization, advantages of linear programming; limitations of linear programming; application areas of linear programming; different types of linear programming (L.P.) problems, mathematical formulation of L.P problems, graphical method of solution for problems in two variables, feasible and infeasible regions, feasible and infeasible solutions, optimum feasible solution.

PAPER II – PROJECT WORK – 20 Marks

Candidates will be expected to have completed **two** projects, one from Section A and one from ***either*** Section B **or** Section C.

The project work will be assessed by the subject teacher and a Visiting Examiner appointed locally and approved by CISCE.

Mark allocation for **each** Project [10 marks]:

Overall format	1 mark
Content	4 marks
Findings	2 marks
Viva-voce based on the Project	3 marks
Total	**10 marks**

List of suggested assignments for Project Work:

Section A

1. Using a graph, demonstrate a function which is one-one but not onto.
2. Using a graph demonstrate a function which is invertible.
3. Construct a composition table using a binary function addition/multiplication modulo upto 5 and verify the existence of the properties of binary operation.
4. Draw the graph of $y = \sin^{-1} x$ (or any other inverse trigonometric function), using the graph of $y = \sin x$ (or any other relevant trigonometric function). Demonstrate the concept of mirror line (about $y = x$) and find its domain and range.
5. Explore the principal value of the function $\sin^{-1} x$ (or any other inverse trigonometric function) using a unit circle.
6. Find the derivatives of a determinant of the order of 3 x 3 and verify the same by other methods.
7. Verify the consistency of the system of three linear equations of two variables and verify the same graphically. Give its geometrical interpretation.
8. For a dependent system (non-homogeneous) of three linear equations of three variables, identify infinite number of solutions.
9. For a given function, give the geometrical interpretation of Mean Value theorems. Explain the significance of closed and open intervals for continuity and differentiability properties of the theorems.
10. Explain the concepts of increasing and decreasing functions, using geometrical significance of *dy/dx*. Illustrate with proper examples.
11. Explain the geometrical significance of point of inflexion with examples and illustrate it using graphs.
12. Explain and illustrate (with suitable examples) the concept of local maxima and local minima using graph.
13. Explain and illustrate (with suitable examples) the concept of absolute maxima and absolute minima using graph.
14. Illustrate the concept of definite integral $\int_a^b f(x)\,dx$, expressing as the limit of a sum and verify it by actual integration.
15. Demonstrate application of differential equations to solve a given problem (example, population increase or decrease, bacteria count in a culture, etc.).
16. Explain the conditional probability, the theorem of total probability and the concept of Bayes' theorem with suitable examples.
17. Explain the types of probability distributions and derive mean and variance of binomial probability distribution for a given function.

Section B

18. Using vector algebra, find the area of a parallelogram/triangle. Also, derive the area analytically and verify the same.
19. Using Vector algebra, prove the formulae of properties of triangles (sine/cosine rule, etc.)
20. Using Vector algebra, prove the formulae of compound angles, e.g. sin (A + B) = Sin A Cos B + Sin B Cos A, etc.
21. Describe the geometrical interpretation of scalar triple product and for a given data, find the scalar triple product.

22. Find the image of a line with respect to a given plane.
23. Find the distance of a point from a given plane measured parallel to a given line.
24. Find the distance of a point from a line measured parallel to a given plane.
25. Find the area bounded by a parabola and an oblique line.
26. Find the area bounded by a circle and an oblique line.
27. Find the area bounded by an ellipse and an oblique line.
28. Find the area bounded by a circle and a circle.
29. Find the area bounded by a parabola and a parabola.
30. Find the area bounded by a circle and a parabola.

(Any other pair of curves which are specified in the syllabus may also be taken.)

Section C

31. Draw a rough sketch of Cost (C), Average Cost (AC) and Marginal Cost (MC)

    Or

    Revenue (R), Average Revenue (AR) and Marginal Revenue (MR).

    Give their mathematical interpretation using the concept of increasing - decreasing functions and maxima-minima.
32. For a given data, find regression equations by the method of least squares. Also find angles between regression lines.
33. Draw the scatter diagram for a given data. Use it to draw the lines of best fit and estimate the value of Y when X is given and vice-versa.
34. Using any suitable data, find the minimum cost by applying the concept of Transportation problem.
35. Using any suitable data, find the minimum cost and maximum nutritional value by applying the concept of Diet problem.
36. Using any suitable data, find the Optimum cost in the manufacturing problem by formulating a linear programming problem (LPP).

NOTE: No question paper for Project Work will be set by CISCE.

SAMPLE TABLE FOR PROJECT WORK

S. No.	Unique Identification Number (Unique ID) of the candidate	PROJECT 1					PROJECT 2					TOTAL MARKS
		A	B	C	D	E	F	G	H	I	J	
		Teacher	Visiting Examiner	Average Marks (A + B ÷ 2)	Viva-Voce by Visiting Examiner	Total Marks (C + D)	Teacher	Visiting Examiner	Average Marks (F + G ÷ 2)	Viva-Voce by Visiting Examiner	Total Marks (H + I)	(E + J)
		7 Marks*	7 Marks*	7 Marks	3 Marks	10 Marks	7 Marks*	7 Marks*	7 Marks	3 Marks	10 Marks	20 Marks
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

*Breakup of 7 Marks to be awarded separately by the Teacher and the Visiting Examiner is as follows:		Name of Teacher: Signature: Date
Overall Format	1 Mark	
Content	4 Marks	Name of Visiting Examiner
Findings	2 Marks	Signature: Date

NOTE: VIVA-VOCE (3 Marks) for each Project is to be conducted only by the Visiting Examiner, and should be based on the Project only

PHYSICS (861)

Aims:

1. To enable candidates to acquire knowledge and to develop an understanding of the terms, facts, concepts, definitions, and fundamental laws, principles and processes in the field of physics.
2. To develop the ability to apply the knowledge and understanding of physics to unfamiliar situations.
3. To develop a scientific attitude through the study of physical sciences.
4. To develop skills in -
   (a) the practical aspects of handling apparatus, recording observations and
   (b) Drawing diagrams, graphs, etc.
5. To develop an appreciation of the contribution of physics towards scientific and technological developments and towards human happiness.
6. To develop an interest in the world of physical sciences.

CLASS XI

There will be two papers in the subject:

***Paper I**: Theory - 3 hours ... 70 marks*

***Paper II**: Practical - 3 hours ... 15 marks*
Project Work ... 10 marks
Practical File ... 5 marks

PAPER I- THEORY: 70 Marks

S. NO.	UNIT	TOTAL WEIGHTAGE
1.	Physical World and Measurement	23 Marks
2.	Kinematics	
3.	Laws of Motion	
4.	Work, Energy and Power	17 Marks
5.	Motion of System of Particles and Rigid Body	
6.	Gravitation	
7.	Properties of Bulk Matter	20 Marks
8.	Heat and Thermodynamics	
9.	Behaviour of Perfect Gases and Kinetic Theory of Gases	
10.	Oscillations and Waves	10 Marks
TOTAL		**70 Marks**

PAPER I -THEORY – 70 MARKS

***Note**: (i) Unless otherwise specified, only S. I. Units are to be used while teaching and learning, as well as for answering questions.*

(ii) All physical quantities to be defined as and when they are introduced along with their units and dimensions.

(iii) Numerical problems are included from all topics except where they are specifically excluded or where only qualitative treatment is required.

1. Physical World and Measurement

Units and Measurements

Measurement: need for measurement; units of measurement; systems of units: fundamental and derived units in SI; measurement of length, mass and time; errors in measurement; significant figures.

Dimensional formulae of physical quantities and constants, dimensional analysis and its applications.

(a) Importance of measurement in scientific studies; physics is a science of measurement. Unit as a reference standard of measurement; essential properties. Systems of units; CGS, FPS, MKS, MKSA, and SI; the seven base units of SI selected by the General Conference of Weights and Measures in 1971 and their definitions, list of fundamental, supplementary and derived physical quantities; their units and symbols (strictly as per rule); subunits and multiple units using prefixes for powers of 10 (from atto for 10^{-18} to tera for 10^{12}); other common units such as fermi, angstrom (now outdated), light year, astronomical unit and parsec. A new unit of mass used in atomic physics is unified atomic mass unit with symbol u (not amu); rules for writing the names of units and their symbols in SI (upper case/lower case.) Derived units (with correct symbols); special names wherever applicable; expression in terms of base units (e.g.: N= kg m/s^2).

(b) Significant figures; their significance; rules for counting the number of significant figures; rules for (a) addition and subtraction, (b) multiplication/ division; 'rounding off' the uncertain digits; order of magnitude as statement of magnitudes in powers of 10; examples from magnitudes of common physical quantities - size, mass, time, etc.

(c) Dimensions of physical quantities; dimensional formula; express derived units in terms of base units (N = kg m/s^2); use symbol [...] for dimensions of or base unit of; e.g.: dimensional formula of force in terms of fundamental quantities written as [F] = [MLT^{-2}].Principle of homogeneity of dimensions. Expressions in terms of SI base units and dimensional formula may be obtained for all physical quantities as and when new physical quantities are introduced.

(d) Use of dimensional analysis to (i) check the dimensional correctness of a formula/ equation; (ii) to obtain the dimensional formula of any derived physical quantity including constants; (iii) to convert units from one system to another; limitations of dimensional analysis.

2. Kinematics

(i) Motion in a Straight Line

Frame of references, Motion in a straight line (one dimension): Position-time graph, speed and velocity.

Elementary concepts of differentiation and integration for describing motion, uniform and non- uniform motion, average speed, velocity, average velocity, instantaneous velocity and uniformly accelerated motion, velocity - time and position - time graphs. Relations for uniformly accelerated motion (graphical treatment).

Frame of reference, concept of point mass, rest and motion; distance and displacement, speed and velocity, average speed and average velocity, uniform velocity, instantaneous speed and instantaneous velocity, acceleration, instantaneous acceleration, s-t, v-t and a-t graphs for uniform acceleration and conclusions drawn from these graphs; kinematic equations of motion for objects in uniformly accelerated rectilinear motion derived using graphical,

calculus or analytical method, motion of an object under gravity, (one dimensional motion).

Differentiation as rate of change; examples from physics – speed, acceleration, velocity gradient, etc. Formulae for differentiation of simple functions: x^n, sinx, cosx, e^x and ln x. Simple ideas about integration – mainly. $\int x^n.dx$. Both definite and indefinite integrals to be mentioned (elementary calculus not to be evaluated).

(ii) Motion in a Plane

Scalar and Vector quantities with examples. Position and displacement vectors, general vectors and their notations; equality of vectors, addition and subtraction of vectors, Unit vector; resolution of a vector in a plane, rectangular components, Scalar and Vector product of two vectors. Projectile motion and uniform circular motion.

(a) General Vectors and notation, position and displacement vector. Vectors explained using displacement as a prototype - along a straight line (one dimensional), on a plane surface (two dimensional) and in an open space not confined to a line or a plane (three dimensional); symbol and representation; a scalar quantity, its representation and unit, equality of vectors. Unit vectors denoted by $\hat{i}$, $\hat{j}$, $\hat{k}$ orthogonal unit vectors along x, y and z axes respectively. Examples of one dimensional vector $\vec{V}_1 = a\hat{i}$ or $b\hat{j}$ or $c\hat{k}$ where a, b, c are scalar quantities or numbers; $\vec{V}_2 = a\hat{i} + b\hat{j}$ is a two dimensional or planar vector, $\vec{V}_3 = a\hat{i} + b\hat{j} + c\hat{k}$ is a three dimensional or space vector. Concept of null vector and co-planar vectors.

(b) Addition: use displacement as an example; obtain triangle law of addition; graphical and analytical treatment; Discuss commutative and associative properties of vector addition (Proof not required). Parallelogram Law; sum and difference; derive expressions for magnitude and direction from parallelogram law; special cases; subtraction as special case of addition with direction reversed; use of Triangle Law for subtraction also; if $\vec{a}+\vec{b}=\vec{c}$; $\vec{c}-\vec{a}=\vec{b}$; In a parallelogram, if one diagonal is the sum, the other diagonal is the difference; addition and subtraction with vectors expressed in terms of unit vectors $\hat{i}, \hat{j}, \hat{k}$; multiplication of a vector by a real number.

(c) Use triangle law of addition to express a vector in terms of its components. If $\vec{a}+\vec{b}=\vec{c}$ is an addition fact, $\vec{c} = \vec{a}+\vec{b}$ is a resolution; $\vec{a}$ and $\vec{b}$ are components of $\vec{c}$. Rectangular components, relation between components, resultant and angle between them. Dot (or scalar) product of vectors $\vec{a}.\vec{b} = abcos\theta$; example $W = \vec{F}.\vec{S} = FS\,Cos\theta$. Special case of $\theta = 0^o, 90^o$ and 180^0. Vector (or cross) product $\vec{a}\times\vec{b} = [absin\theta]\hat{n}$; example: torque $\vec{\tau} = \vec{r}\times\vec{F}$; Special cases using unit vectors $\hat{i}, \hat{j}, \hat{k}$ for $\vec{a}.\vec{b}$ and $\vec{a}\times\vec{b}$.

(d) Various terms related to projectile motion; obtain equations of trajectory, time of flight, maximum height, horizontal range, instantaneous velocity, [projectile motion on an inclined plane not included]. Examples of projectile motion.

(e) Examples of uniform circular motion: details to be covered in unit 3 (d).

3. Laws of Motion

General concept of force, inertia, Newton's first law of motion; momentum and Newton's second law of motion; impulse; Newton's third law of motion.

Law of conservation of linear momentum and its applications.

Equilibrium of concurrent forces. Friction: Static and kinetic friction, laws of friction, rolling friction, lubrication.

Dynamics of uniform circular motion: Centripetal force, examples of circular motion (vehicle on a level circular road, vehicle on a banked road).

(a) *Newton's first law: Statement and explanation; concept of inertia, mass, force; law of inertia; mathematically, if $\Sigma F=0$, $a=0$.*

Newton's second law: $\vec{p}=m\vec{v}$; $\vec{F}\ \alpha\ \frac{d\vec{p}}{dt}$; $\vec{F}=k\frac{d\vec{p}}{dt}$. Define unit of force so that k=1; $\vec{F}=\frac{d\vec{p}}{dt}$; a vector equation. For classical physics with v not large and mass m remaining constant, obtain $\vec{F}=m\vec{a}$. For $v\rightarrow c$, m is not constant. Then $m=m_0/\sqrt{1-v^2/c^2}$ Note that F= ma is the special case for classical mechanics. It is a vector equation. $\vec{a}\,||\,\vec{F}$. Also, this can be resolved into three scalar equations $F_x=ma_x$ etc. Application to numerical problems; introduce tension force, normal reaction force. If a = 0 (body in equilibrium), F= 0. Statement, derivation and explanation of principle of conservation of linear momentum. Impulse of a force: $F\Delta t=\Delta p$.

Newton's third law. Obtain it using Law of Conservation of linear momentum. Proof of Newton's second law as real law. Systematic solution of problems in mechanics; isolate a part of a system, identify all forces acting on it; draw a free body diagram representing the part as a point and representing all forces by line segments, solve for resultant force which is equal to $m\vec{a}$. Simple problems on "Connected bodies" (not involving two pulleys).

(b) *Force diagrams; resultant or net force from Triangle law of Forces, parallelogram law or resolution of forces. Apply net force $\Sigma\vec{F}=m\vec{a}$. Again for equilibrium a=0 and $\Sigma F=0$. Conditions of equilibrium of a rigid body under three coplanar forces. Discuss ladder problem.*

(c) *Friction; classical view and modern view of friction, static friction a self-adjusting force; limiting value; kinetic friction or sliding friction; rolling friction, examples.*

Laws of friction: Two laws of static friction; (similar) two laws of kinetic friction; coefficient of friction $\mu_s = f_s(max)/N$ and $\mu_k = f_k/N$; graphs. Friction as a non-conservative force; motion under friction, net force in Newton's 2nd law is calculated including f_k. Motion along a rough inclined plane – both up and down. Pulling and pushing of a roller. Angle of friction and angle of repose. Lubrication, use of bearings, streamlining, etc.

(d) *Angular displacement (θ), angular velocity (ω), angular acceleration (α) and their relations. Concept of centripetal acceleration; obtain an expression for this acceleration using $\Delta\vec{v}$. Magnitude and direction of $\vec{a}$ same as that of $\Delta\vec{v}$; Centripetal acceleration; the cause of this acceleration is a force - also called centripetal force; the name only indicates its direction, it is not a new type of force, motion in a vertical circle; banking of road and railway track (conical pendulum is excluded).*

4. Work, Power and Energy

Work done by a constant force and a variable force; kinetic energy, work-energy theorem, power.

Potential energy, potential energy of a spring, conservative forces: conservation of mechanical energy (kinetic and potential energies); Conservative and non-conservative forces. Concept of collision: elastic and inelastic collisions in one and two dimensions.

(i) *Work done $W=\vec{F}.\vec{S}=FS\cos\theta$. If F is variable $dW=\vec{F}.d\vec{S}$ and $W=\int dw=\int\vec{F}.d\vec{S}$, for $\vec{F}\,\|\,d\vec{S}$ $\vec{F}.d\vec{S}=FdS$ therefore, $W=\int FdS$ is the area under the F-S graph or if F can be expressed in terms of S, $\int FdS$ can be evaluated. Example, work done in stretching*

a spring $W = \int F dx = \int kx dx = \frac{1}{2} kx^2$. *This is also the potential energy stored in the stretched spring* $U = \frac{1}{2} kx^2$.

Kinetic energy and its expression, Work-Energy theorem E=W. Law of Conservation of Energy; oscillating spring. $U+K = E = K_{max} = U_{max}$ *(for U = 0 and K = 0 respectively); graph different forms of energy and their transformations.* $E = mc^2$ *(no derivation). Power P=W/t;* $P = \vec{F}.\vec{v}$.

(ii) Collision in one dimension; derivation of velocity equation for general case of $m_1 \neq m_2$ *and* $u_1 \neq u_2 = 0$*; Special cases for* $m_1 = m_2 = m$*;* $m_1 >> m_2$ *or* $m_1 << m_2$*. Oblique collisions i.e. collision in two dimensions.*

5. Motion of System of Particles and Rigid Body

Idea of centre of mass: centre of mass of a two-particle system, momentum conservation and centre of mass motion. Centre of mass of a rigid body; centre of mass of a uniform rod.

Moment of a force, torque, angular momentum, laws of conservation of angular momentum and its applications.

Equilibrium of rigid bodies, rigid body rotation and equations of rotational motion, comparative study of linear and rotational motions.

Moment of inertia, radius of gyration, moments of inertia for simple geometrical objects (no derivation). Statement of parallel and perpendicular axes theorems and their applications.

Definition of centre of mass (cm), centre of mass (cm) for a two particle system $m_1x_1+m_2x_2 = Mx_{cm}$*; differentiating, get the equation for* v_{cm} *and* a_{cm}*; general equation for N particles- many particles system; [need not go into more details];centre of gravity, principle of moment, discuss ladder problem, concept of a rigid body; kinetic energy of a rigid body rotating about a fixed axis in terms of that of the particles of the body; hence, define moment of inertia and radius of gyration; physical significance of moment of inertia; unit and dimension; depends on mass and axis of rotation; it is rotational inertia; equations of rotational motions. Applications: only expression for the moment of inertia, I (about the symmetry axis) of: (i) a ring; (ii) a solid and a hollow cylinder, (iii) a thin rod (iv) a solid and a hollow sphere, (v) a disc - only formulae (no derivations required).*

(a) Statements of the parallel and perpendicular axes theorems with illustrations [derivation not required]. Simple examples with change of axis.

(b) Definition of torque (vector); $\vec{\tau} = \vec{r} \times \vec{F}$ *and angular momentum* $\vec{L} = \vec{r} \times \vec{p}$ *for a particle (no derivations); differentiate to obtain* $d\vec{L}/dt = \vec{\tau}$ *; similar to Newton's second law of motion (linear);hence* $\tau = I\alpha$ *and* $L = I\omega$*; (only scalar equation); Law of conservation of angular momentum; simple applications. Comparison of linear and rotational motions.*

6. Gravitation

Kepler's laws of planetary motion, universal law of gravitation. Acceleration due to gravity (g) and its variation with altitude, latitude and depth.

Gravitational potential and gravitational potential energy, escape velocity, orbital velocity of a satellite, Geo-stationary satellites.

(i) Newton's law of universal gravitation; Statement; unit and dimensional formula of universal gravitational constant, G [Cavendish experiment not required]; gravitational acceleration on surface of the earth (g), weight of a body W= mg from F=ma.

(ii) Relation between g and G. Derive the expression for variation of g above and below the surface of the earth; graph; mention variation of g with latitude and rotation, (without derivation).

(iii) Gravitational field, intensity of gravitational field and potential at a point in earth's gravitational field. $V_p = W_{ap}/m$*. Derive expression (by integration) for the gravitational potential difference* $\Delta V = V_B - V_A = GM(1/r_A - 1/r_B)$*; here* $V_p = V(r) = -GM/r$*; negative sign for attractive force field; define gravitational potential energy of a mass m in the earth's field; expression for gravitational potential*

energy $U(r) = W_{\alpha p} = m.V(r) = -G\,M\,m/r$; show that $\Delta U = mgh$, for $h << R$. Relation between intensity and acceleration due to gravity.

(iv) Derive expression for the escape velocity of earth using energy consideration; v_e depends on mass of the earth; for moon v_e is less as mass of moon is less; consequence - no atmosphere on the moon.

(v) Satellites (both natural (moon) and artificial) in uniform circular motion around the earth; Derive the expression for orbital velocity and time period; note the centripetal acceleration is caused (or centripetal force is provided) by the force of gravity exerted by the earth on the satellite; the acceleration of the satellite is the acceleration due to gravity [$g' = g(R/R+h)^2$; $F'_G = mg'$]. Weightlessness; g*eostationary satellites; conditions for satellite to be geostationary; parking orbit, calculation of its radius and height; basic concept of polar satellites and their uses.*

(vi) Kepler's laws of planetary motion: *explain the three laws using diagrams. Proof of third law (for circular orbits only).*

7. Properties of Bulk Matter

(i) Mechanical Properties of Solids: Elastic behaviour of solids, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear modulus of rigidity, Poisson's ratio; elastic energy (qualitative treatment only).

Elasticity in solids, Hooke's law, Young's modulus and its determination, bulk modulus and shear modulus of rigidity, work done in stretching a wire and strain energy, Poisson's ratio.

(ii) Mechanical Properties of Fluids

Pressure due to a fluid column; Pascal's law and its applications (hydraulic lift and hydraulic brakes), effect of gravity on fluid pressure.

Viscosity, Stokes' law, terminal velocity, streamline and turbulent flow, critical velocity, Bernoulli's theorem and its applications.

Surface energy and surface tension, angle of contact, excess of pressure across a curved surface, application of surface tension ideas to drops, bubbles and capillary rise.

(a) Pressure in a fluid, Pascal's Law and its applications, buoyancy (Archimedes Principle).

(b) General characteristics of fluid flow; equation of continuity $v_1a_1 = v_2a_2$; conditions; applications like use of nozzle at the end of a hose; Bernoulli's principle (theorem); assumptions - incompressible liquid, streamline (steady) flow, non-viscous and irrotational liquid - ideal liquid; derivation of equation; applications of Bernoulli's theorem atomizer, dynamic uplift, Venturimeter, Magnus effect etc.

(c) Streamline and turbulent flow - examples; streamlines do not intersect (like electric and magnetic lines of force); tubes of flow; number of streamlines per unit area α velocity of flow (from equation of continuity $v_1a_1 = v_2a_2$); critical velocity; Reynold's number (significance only) Poiseuille's formula with numericals.

(d) Viscous drag; Newton's formula for viscosity, co-efficient of viscosity and its units.

Flow of fluids (liquids and gases), laminar flow, internal friction between layers of fluid, between fluid and the solid with which the fluid is in relative motion; examples; viscous drag is a force of friction; mobile and viscous liquids.

Velocity gradient dv/dx (space rate of change of velocity); viscous drag $F = \eta A\, dv/dx$; coefficient of viscosity $\eta = F/A\,(dv/dx)$ depends on the nature of the liquid and its temperature; units: Ns/m^2 and $dyn.s/cm^2$= poise.1 poise=0.1 Ns/m^2.

(e) Stoke's law, motion of a sphere falling through a fluid, hollow rigid sphere rising to the surface of a liquid, parachute, obtain the expression of

terminal velocity; forces acting; viscous drag, a force proportional to velocity; Stoke's law; v-t graph.

(f) Surface tension (molecular theory), drops and bubbles, angle of contact, work done in stretching a surface and surface energy, capillary rise, measurement of surface tension by capillary (uniform bore) rise method. Excess pressure across a curved surface, application of surface tension for drops and bubbles.

8. Heat and Thermodynamics

(i) Thermal Properties of Matter: Heat, temperature, thermal expansion; thermal expansion of solids, liquids and gases, anomalous expansion of water; specific heat capacity, calorimetry; change of state, specific latent heat capacity.

Heat transfer-conduction, convection and radiation, thermal conductivity, qualitative ideas of Blackbody radiation, Wien's displacement Law and Stefan's law.

(a) Temperature and Heat, measurement of temperature (scales and inter conversion). Ideal gas equation and absolute temperature, thermal expansion in solids, liquids and gases. Specific heat capacity, calorimetry, change of state, latent heat capacity, steady state and temperature gradient. Thermal conductivity; co-efficient of thermal conductivity, Use of good and poor conductors, Searle's experiment, (Lee's Disc method is not required). Convection with examples.

(b) Black body is now called ideal or cavity radiator and black body radiation is cavity radiation; Stefan's law is now known as Stefan Boltzmann law as Boltzmann derived it theoretically. There is multiplicity of technical terms related to thermal radiation - radiant intensity I (T) for total radiant power (energy radiated/second) per unit area of the surface, in W/m^2, $I(T) = \sigma T^4$; dimension and SI unit of σ. For practical radiators $I = \epsilon . \sigma T^4$ where ϵ (dimension less) is called emissivity of the surface material; $\epsilon=1$ for ideal radiators. The Spectral radiancy $R(\lambda)$. $I(T) = \int_0^{\alpha} R(\lambda) d\lambda$.

Graph of $R(\lambda)$ vs λ for different temperatures. Area under the graph is I (T). The λ corresponding to maximum value of R is called λ_{max}; decreases with increase in temperature.

Wien's displacement law; Stefan's law and Newton's law of cooling. [Deductions from Stefan's law not necessary].

(ii) Thermodynamics

Thermal equilibrium and definition of temperature (zeroth law of thermodynamics), heat, work and internal energy. First law of thermodynamics, isothermal and adiabatic processes.

Second law of thermodynamics: reversible and irreversible processes.

(a) Thermal equilibrium and zeroth law of thermodynamics: Self explanatory

(b) First law of thermodynamics.

Concept of heat (Q) as the energy that is transferred (due to temperature difference only) and not stored; the energy that is stored in a body or system as potential and kinetic energy is called internal energy (U). Internal energy is a state property (only elementary ideas) whereas, heat is not; first law is a statement of conservation of energy, when, in general, heat (Q) is transferred to a body (system), internal energy (U) of the system changes and some work W is done by the system; then $Q=\Delta U+W$; also $W=\int pdV$ for working substance - an ideal gas; explain the meaning of symbols (with examples) and sign convention carefully (as used in physics: $Q>0$ when added to a system, $\Delta U>0$ when U increases or temperature rises, and $W>0$ when work is done by the system). Special cases for $Q=0$ (adiabatic), $\Delta U=0$ (isothermal) and $W=0$ (isochoric).

(c) *Isothermal and adiabatic changes in a perfect gas described in terms of PV graphs; PV = constant (Isothermal) and PV^{γ} = constant (adiabatic); joule and calorie relation (derivation of PV^{γ} = constant not required).*

Note that 1 cal = 4·186 J exactly and J (so-called mechanical equivalent of heat) should not be used in equations. In equations, it is understood that each term as well as the LHS and RHS are in the same units; it could be all joules or all calories.

(d) *Derive an expression for work done in isothermal and adiabatic processes; principal and molar heat capacities; C_p and C_v; relation between C_p and C_v (C_p - C_v = R).* W*ork done as area bounded by PV graph.*

(e) *Second law of thermodynamics, Carnot's cycle. Some practical applications.*

Only one statement each in terms of Kelvin's impossible steam engine and Clausius' impossible refrigerator. Brief explanation of the law. Reversible and irreversible processes, Heat engine; Carnot's cycle - describe realisation from source and sink of infinite thermal capacity, thermal insulation, etc. Explain using pV graph (isothermal process and adiabatic process) expression and numericals (without derivation) for efficiency $\eta=1-T_2/T_1$.

9. Behaviour of Perfect Gases and Kinetic Theory of Gases

(i) Kinetic Theory: Equation of state of a perfect gas, work done in compressing a gas. Kinetic theory of gases - assumptions, concept of pressure. Kinetic interpretation of temperature; rms speed of gas molecules; degrees of freedom, law of equi-partition of energy (statement only) and application to specific heat capacities of gases; concept of mean free path, Avogadro's number**.**

(a) *Kinetic Theory of gases; derive $p=1/3\ \rho\overline{c^2}$ from the assumptions and applying Newton's laws of motion. The average thermal velocity (rms value) $c_{rms}=\sqrt{3p/\rho}$; calculations for air, hydrogen and their comparison with common speeds. Effect of temperature and pressure on rms speed of gas molecules.*

[Note that pV=nRT the ideal gas equation cannot be derived from kinetic theory of ideal gas. Hence, neither can other gas laws; pV=nRT is an experimental result. Comparing this with $p = \frac{1}{3}\ \rho\overline{c^2}$, from kinetic theory of gases, a kinetic interpretation of temperature can be obtained as explained in the next subunit].

(b) *From kinetic theory for an ideal gas (obeying all the assumptions especially no intermolecular attraction and negligibly small size of molecules, we get $p = (1/3)\rho\ \overline{c^2}$ or $pV = (1/3)M\overline{c^2}$. (No further, as temperature is not a concept of kinetic theory). From experimentally obtained gas laws, we have the ideal gas equation (obeyed by some gases at low pressure and high temperature) pV = RT for one mole. Combining these two results (assuming they can be combined), $RT=(1/3)M\overline{c^2}=(2/3).\frac{1}{2}M\overline{c^2}=(2/3)K$;*
Hence, kinetic energy of 1 mole of an ideal gas K=(3/2)RT. Average K for 1 molecule = K/N = (3/2) RT/N = (3/2) kT where k is Boltzmann's constant. So, temperature T can be interpreted as a measure of the average kinetic energy of the molecules of a gas.

(c) *Degrees of freedom and calculation of specific heat capacities for all types of gases. Concept of the law of equipartition of energy (derivation not required). Concept of mean free path and Avogadro's number N_A.*

10. Oscillations and Waves

(i) Oscillations: Periodic motion, time period, frequency, displacement as a function of time, periodic functions. Simple harmonic motion (S.H.M) and its equation; phase; oscillations of a spring, restoring force and force constant; energy in S.H.M., Kinetic and potential energies; simple pendulum and derivation of expression for its time period.

Simple harmonic motion. Periodic motion, time period T and frequency f, f=1/T; uniform circular motion and its projection on a diameter defines SHM; displacement, amplitude, phase and epoch, velocity, acceleration, time period; characteristics of SHM; Relation between linear simple harmonic motion and uniform circular motion. Differential equation of SHM, $d^2y/dt^2+\omega^2y=0$ from the nature of force acting F=-k y; solution $y=A \sin(\omega t+\phi_0)$ where $\omega^2 = k/m$; obtain expressions for velocity, acceleration, time period T and frequency f. Graphical representation of displacement, velocity and acceleration. Examples, simple pendulum, a mass m attached to a spring of spring constant k. Derivation of time period of simple harmonic motion of a simple pendulum, mass on a spring (horizontal and vertical oscillations) Kinetic and potential energy at a point in simple harmonic motion. Total energy E = U+K (potential +kinetic) is conserved. Draw graphs of U, K and E Verses y.

(ii) Waves: Wave motion, Transverse and longitudinal waves, speed of wave motion, displacement relation for a progressive wave, principle of superposition of waves, reflection of waves, standing waves in strings and organ pipes, fundamental mode and harmonics, Beats.

(a) Transverse and longitudinal waves; characteristics of a harmonic wave; graphical representation of a harmonic wave. Distinction between transverse and longitudinal waves; examples; displacement, amplitude, time period, frequency, wavelength, derive $v=f\lambda$; graph of displacement with time/position, label time period/wavelength and amplitude, equation of a progressive harmonic (sinusoidal) wave, $y = A \sin(kx\pm\omega t)$ where k is a propagation factor and equivalent equations.

(b) Production and propagation of sound as a wave motion; mechanical wave requires a medium; general formula for speed of sound (no derivation). Newton's formula for speed of sound in air; experimental value; Laplace's correction; variation of speed v with changes in pressure, density, humidity and temperature. Speed of sound in liquids and solids - brief introduction only. Concept of supersonic and ultrasonic waves.

(c) Principle of superposition of waves; interference (simple ideas only); dependence of combined wave form, on the relative phase of the interfering waves; qualitative only - illustrate with wave representations. Beats (qualitative explanation only); number of beats produced per second = difference in the frequencies of the interfering waves. Standing waves or stationary waves; formation by two identical progressive waves travelling in opposite directions (e.g., along a string, in an air column - incident and reflected waves); obtain $y= y_1+y_2= [2\ y_m \sin(kx)] \cos(\omega t)$ using equations of the travelling waves; variation of the amplitude $A=2\ y_m \sin(kx)$ with location (x) of the particle; nodes and antinodes; compare standing waves with progressive waves.

(d) Laws of vibrations of a stretched string. Obtain equation for fundamental frequency $f_0=(½l)\sqrt{T/m}$; sonometer.

(e) Modes of vibration of strings and air columns (closed and open pipes); standing waves with nodes and antinodes; also in resonance with the periodic force exerted usually by a tuning fork; sketches of various modes of vibration; obtain expressions for fundamental frequency and various harmonics and overtones; mutual relations.

PAPER II

PRACTICAL WORK- 15 Marks

Given below is a list of required experiments. Teachers may add to this list, keeping in mind the general pattern of questions asked in the annual examinations.

In each experiment, students are expected to record their observations in a tabular form with units at the column head. Students should plot an appropriate graph, work out the necessary calculations and arrive at the result.

Students are required to have completed all experiments from the given list (excluding demonstration experiments):

1. To measure the diameter of a spherical body using Vernier calipers. Calculate its volume with appropriate significant figures. Also measure its volume using a graduated cylinder and compare the two.
2. Find the diameter of a wire using a micrometer screw gauge and determine percentage error in cross sectional area.
3. Determine radius of curvature of a spherical surface like watch glass by a spherometer.
4. Equilibrium of three concurrent coplanar forces. To verify the parallelogram law of forces and to determine weight of a body.
5. (i) Inclined plane: To find the downward force acting along the inclined plane on a roller due to gravitational pull of earth and to study its relationship with angle of inclination by plotting graph between force and sin θ.

   (ii) Friction: To find the force of limiting friction for a wooden block placed on horizontal surface and to study its relationship with normal reaction. To determine the coefficient of friction.
6. To find the acceleration due to gravity by measuring the variation in time period (T) with effective length (L) of a simple pendulum; plot graphs of T vs $\sqrt{L}$ and T^2 vs L. Determine effective length of the seconds pendulum from T^2 vs L graph.
7. To find the force constant of a spring and to study variation in time period of oscillation with mass m of a body suspended by the spring. To find acceleration due to gravity by plotting a graph of T against $\sqrt{m}$.
8. Boyle's Law: To study the variation in volume with pressure for a sample of air at constant temperature by plotting graphs between p and $1/V$ and between p and V.
9. Cooling curve: To study the fall in temperature of a body (like hot water or liquid in calorimeter) with time. Find the slope of the curve at four different temperatures of the hot body and hence, deduce Newton's law of cooling.
10. To study the variation in frequency of air column with length using resonance column apparatus or a long cylindrical vessel and a set of tuning forks. Hence, determine velocity of sound in air at room temperature.
11. To determine frequency of a tuning fork using a sonometer.
12. To determine specific heat capacity of a solid using a calorimeter.

Demonstration Experiments *(The following experiments are to be demonstrated by the teacher)*:

1. Searle's method to determine Young modulus of elasticity.
2. Capillary rise method to determine surface tension of water.
3. Determination of coefficient of viscosity of a given viscous liquid by terminal velocity method.

PROJECT WORK AND PRACTICAL FILE – 15 Marks

Project Work – 10 Marks

All candidates will be required to do **one** project involving some Physics related topic/s, under the guidance and regular supervision of the Physics teacher. Candidates are to prepare a technical report including an abstract, some theoretical discussion, experimental setup, observations with tables of data collected, analysis and discussion of results, deductions, conclusion, etc. (after the draft has been approved by the teacher). The report should be kept simple, but neat and elegant. Teachers may assign or students may choose any one project of their choice.

Suggested Evaluation criteria:

▪ Title and Abstract (summary)
▪ Introduction / purpose
▪ Contents/Presentation
▪ Analysis/ material aid (graph, data, structure, pie charts, histograms, diagrams, etc.)
▪ Originality of work
▪ Conclusion/comments

Practical File – 5 Marks

Teachers are required to assess students on the basis of the Physics practical file maintained by them during the academic year.

NOTE: For guidelines regarding Project Work, please refer to Class XII.

CLASS XII

There will be two papers in the subject:

***Paper I**: Theory - 3 hours ... 70 marks*

***Paper II**: Practical - 3 hours ... 15 marks*
Project Work ... 10 marks
Practical File ... 5 marks

PAPER I- THEORY: 70 Marks

S. NO.	UNIT	TOTAL WEIGHTAGE
1.	Electrostatics	14 Marks
2.	Current Electricity	
3.	Magnetic Effects of Current and Magnetism	16 Marks
4.	Electromagnetic Induction and Alternating Currents	
5.	Electromagnetic Waves	2 Marks
6.	Optics	18 Marks
7.	Dual Nature of Radiation and Matter	7 Marks
8.	Atoms and Nuclei	6 Marks
9.	Electronic Devices	7 Marks
TOTAL		**70 Marks**

PAPER I -THEORY- 70 Marks

Note: *(i) Unless otherwise specified, only S. I. Units are to be used while teaching and learning, as well as for answering questions.*

(ii) All physical quantities to be defined as and when they are introduced along with their units and dimensions.

(iii) Numerical problems are included from all topics except where they are specifically excluded or where only qualitative treatment is required.

1. Electrostatics

(i) Electric Charges and Fields

Electric charges; conservation and quantisation of charge, Coulomb's law; superposition principle and continuous charge distribution.

Electric field: electric field due to a point charge, electric field lines, electric dipole, electric field due to a dipole, torque on a dipole in uniform electric field.

Electric flux, Gauss's theorem in Electrostatics and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell.

(a) Coulomb's law, S.I. unit of charge; permittivity of free space and of dielectric medium. Frictional electricity, electric charges (two types); repulsion and attraction; simple atomic structure - electrons and ions; conductors and insulators; quantization and conservation of electric charge; Coulomb's law in vector form; (position coordinates r_1, r_2 not necessary). Comparison with Newton's law of gravitation; Superposition principle $\left(\vec{F}_1 = \vec{F}_{12} + \vec{F}_{13} + \vec{F}_{14} + \cdots\right)$.

(b) Concept of electric field and its intensity; examples of different fields; gravitational, electric and magnetic; Electric field due to a point charge $\vec{E} = \vec{F} / q_o$ *(q_0 is a test charge);* $\vec{E}$ *for a group of charges (superposition principle); a point charge q in an electric field* $\vec{E}$ *experiences an electric force* $\vec{F}_E = q\vec{E}$. *Intensity due to a continuous distribution of charge i.e. linear, surface and volume.*

(c) Electric lines of force: A convenient way to visualize the electric field; properties of lines of force; examples of the lines of force due to (i) an isolated point charge (+ve and - ve); (ii) dipole, (iii) two similar charges at a small distance;(iv) uniform field between two oppositely charged parallel plates.

(d) Electric dipole and dipole moment; derivation of the $\vec{E}$ *at a point, (1) on the axis (end on position) (2) on the perpendicular bisector (equatorial i.e. broad side on position) of a dipole, also for r>> 2l (short dipole); dipole in a uniform electric field; net force zero, torque on an electric dipole:* $\vec{\tau} = \vec{p} \times \vec{E}$ *and its derivation.*

(e) Gauss' theorem: the flux of a vector field; Q=vA for velocity vector $\vec{v} \| \vec{A}$, $\vec{A}$ *is area vector. Similarly, for electric field* $\vec{E}$, *electric flux* $\phi_E = EA$ *for* $\vec{E} \| \vec{A}$ *and* $\phi_E = \vec{E} \cdot \vec{A}$ *for uniform* $\vec{E}$. *For non-uniform field* $\phi_E = \int d\phi = \int \vec{E}.d\vec{A}$. *Special cases for* $\theta = 0^0$, 90^0 *and* 180^0. *Gauss' theorem, statement:* $\phi_E = q/\epsilon_0$ *or* $\phi_E = \oint \vec{E} \cdot \vec{dA} = \frac{q}{\epsilon_0}$ *where* ϕ_E *is for a closed surface; q is the net charge enclosed,* ϵ_o *is the permittivity of free space. Essential properties of a Gaussian surface.*

Applications: Obtain expression for $\vec{E}$ *due to 1. an infinite line of charge, 2. a uniformly charged infinite plane thin sheet, 3. a thin hollow spherical shell (inside, on the surface and outside). Graphical variation of E vs r for a thin spherical shell.*

(ii) Electrostatic Potential, Potential Energy and Capacitance

Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of two point charges and of electric dipole in an electrostatic field.

Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarisation, capacitors and capacitance, combination of capacitors in series and in parallel. Capacitance of a parallel plate capacitor, energy stored in a capacitor (No derivation, formulae only).

(a) Concept of potential, potential difference and potential energy. Equipotential surface and its properties. Obtain an expression for electric potential at a point due to a point charge; graphical variation of E and V vs r, $V_P=W/q_0$; hence $V_A - V_B = W_{BA}/q_0$ (taking q_0 from B to A) = $(q/4\pi\varepsilon_0)(1/r_A - 1/r_B)$; derive this equation; also $V_A = q/4\pi\varepsilon_0 .1/r_A$; for $q>0$, $V_A>0$ and for $q<0$, $V_A < 0$. For a collection of charges V = algebraic sum of the potentials due to each charge; potential due to a dipole on its axial line and equatorial line; also at any point for $r>>2l$ (short dipole). Potential energy of a point charge (q) in an electric field $\vec{E}$, placed at a point P where potential is V, is given by $U = qV$ and $\Delta U = q(V_A - V_B)$. The electrostatic potential energy of a system of two charges = work done $W_{21}=W_{12}$ in assembling the system; U_{12} or $U_{21} = (1/4\pi\varepsilon_0) q_1q_2/r_{12}$. For a system of 3 charges $U_{123} = U_{12} + U_{13} + U_{23}$ $= \frac{1}{4\pi\varepsilon_0}\left(\frac{q_1q_2}{r_{12}} + \frac{q_1q_3}{r_{13}} + \frac{q_2q_3}{r_{23}}\right)$. For a dipole in a uniform electric field, derive an expression of the electric potential energy $U_E = -\vec{p}.\vec{E}$, special cases for $\phi = 0^0, 90^0$ and 180^0.

(b) Capacitance of a conductor C = Q/V; obtain the capacitance of a parallel-plate capacitor ($C = \in_0 A/d$) and equivalent capacitance for capacitors in series and parallel combinations. Expression for energy stored ($U = \frac{1}{2}CV^2 = \frac{1}{2}QV = \frac{1}{2}\frac{Q^2}{C}$) and energy density.

(c) Dielectric constant $K = C'/C$; this is also called relative permittivity $K = \in_r = \in/\in_o$; elementary ideas of polarization of matter in a uniform electric field qualitative discussion; induced surface charges weaken the original field; results in reduction in $\vec{E}$ and hence, in pd, (V); for charge remaining the same $Q = CV = C'V' = K.CV'$; $V' = V/K$; and $E' = E/K$; if the Capacitor is kept connected with the source of emf, V is kept constant $V = Q/C = Q'/C'$; $Q'=C'V = K.CV = K.Q$ increases; For a parallel plate capacitor with a dielectric in between, $C' = KC = K.\in_o . A/d = \in_r .\in_o .A/d$. Then $C' = \frac{\in_0 A}{\left(d/\in_r\right)}$; for a capacitor partially filled dielectric, capacitance, $C' = \in_o A/(d - t + t/\in_r)$.

2. Current Electricity

Mechanism of flow of current in conductors. Mobility, drift velocity and its relation with electric current; Ohm's law and its proof, resistance and resistivity and their relation to drift velocity of electrons; V-I characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity. Temperature dependence of resistance and resistivity.

Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel, Kirchhoff's laws and simple applications, Wheatstone bridge, metre bridge. Potentiometer - principle and its applications to measure potential difference, to compare emf of two cells; to measure internal resistance of a cell.

(a) *Free electron theory of conduction; acceleration of free electrons, relaxation time τ ; electric current I = Q/t; concept of drift velocity and electron mobility. Ohm's law, current density J = I/A; experimental verification, graphs and slope, ohmic and non-ohmic conductors; obtain the relation $I=v_d enA$. Derive $\sigma = ne^2\tau/m$ and $\rho = m/ne^2\tau$; effect of temperature on resistivity and resistance of conductors and semiconductors and graphs. Resistance R= V/I; resistivity ρ, given by $R = \rho.l/A$; conductivity and conductance; Ohm's law as* $\vec{J} = \sigma \vec{E}$.

(b) *Electrical energy consumed in time t is E=Pt= VIt; using Ohm's law* $E = \left(V^2/R\right)t = I^2Rt$. *Potential difference V = P/ I; P = V I; Electric power consumed* $P = VI = V^2/R = I^2 R$; *commercial units; electricity consumption and billing.*

(c) *The source of energy of a seat of emf (such as a cell) may be electrical, mechanical, thermal or radiant energy. The emf of a source is defined as the work done per unit charge to force them to go to the higher point of potential (from -ve terminal to +ve terminal inside the cell) so, $\varepsilon = dW/dq$; but $dq = Idt$; $dW = \varepsilon dq = \varepsilon Idt$. Equating total work done to the work done across the external resistor R plus the work done across the internal resistance r; $\varepsilon Idt = I^2R\,dt + I^2rdt$; $\varepsilon = I(R + r)$; $I=\varepsilon/(R + r)$; also $IR + Ir = \varepsilon$ or $V=\varepsilon - Ir$ where Ir is called the back emf as it acts against the emf ε; V is the terminal pd. Derivation of formulae for combination for identical cells in series, parallel and mixed grouping. Parallel combination of two cells of unequal emf. Series combination of n cells of unequal emf.*

(d) *Statement and explanation of Kirchhoff's laws with simple examples. The first is a conservation law for charge and the 2nd is law of conservation of energy. Note change in potential across a resistor $\Delta V=IR<0$ when we go 'down' with the current (compare with flow of water down a river), and $\Delta V=IR>0$ if we go up against the current across the resistor. When we go through a cell, the -ve terminal is at a lower level and the +ve terminal at a higher level, so going from -ve to +ve through the cell, we are going up and $\Delta V=+\varepsilon$ and going from +ve to -ve terminal through the cell, we are going down, so $\Delta V = -\varepsilon$. Application to simple circuits. Wheatstone bridge; right in the beginning take $I_g=0$ as we consider a balanced bridge, derivation of $R_1/R_2 = R_3/R_4$ [Kirchhoff's law not necessary]. Metre bridge is a modified form of Wheatstone bridge, its use to measure unknown resistance. Here $R_3 = l_1\rho$ and $R_4=l_2\rho$; $R_3/R_4=l_1/l_2$. Principle of Potentiometer: fall in potential $\Delta V \alpha \Delta l$; auxiliary emf ε_1 is balanced against the fall in potential V_1 across length l_1. $\varepsilon_1 = V_1 = Kl_1$; $\varepsilon_1/\varepsilon_2 = l_1/l_2$; potentiometer as a voltmeter. Potential gradient and sensitivity of potentiometer. Use of potentiometer: to compare emfs of two cells, to determine internal resistance of a cell.*

3. Magnetic Effects of Current and Magnetism

(i) Moving charges and magnetism

Concept of magnetic field, Oersted's experiment. Biot - Savart law and its application. Ampere's Circuital law and its applications to infinitely long straight wire, straight solenoids (only qualitative treatment). Force on a moving charge in uniform magnetic and electric fields. Force on a current-carrying conductor in a uniform magnetic field, force between two parallel current-carrying conductors-definition of ampere, torque experienced by a current loop in uniform magnetic field; moving coil galvanometer - its sensitivity. Conversion of galvanometer into an ammeter and a voltmeter.

(ii) Magnetism and Matter

A current loop as a magnetic dipole, its magnetic dipole moment, magnetic dipole moment of a revolving electron, magnetic field intensity due to a magnetic dipole (bar magnet) on the axial line and equatorial line (Qualitative only) torque on a magnetic dipole (bar magnet) in a uniform magnetic field; bar magnet as an equivalent solenoid. Diamagnetic, paramagnetic, and

ferromagnetic substances, with examples. Electromagnets and factors affecting their strengths, permanent magnets.

(a) Only historical introduction through Oersted's experiment. [Ampere's swimming rule not included]. Biot-Savart law and its vector form; application; derive the expression for B (i) at the centre of a circular loop carrying current; (ii) at any point on its axis. Current carrying loop as a magnetic dipole. Ampere's Circuital law: statement and brief explanation. Apply it to obtain $\vec{B}$ near a long wire carrying current and for a solenoid. Only formula of $\vec{B}$ due to a finitely long conductor.

(b) Force on a moving charged particle in magnetic field $\vec{F}_B = q\left(\vec{v} \times \vec{B}\right)$; special cases, modify this equation substituting $d\vec{l}/dt$ for v and I for q/dt to yield $\vec{F} = I d\vec{l} \times \vec{B}$ for the force acting on a current carrying conductor placed in a magnetic field. Derive the expression for force between two long and parallel wires carrying current, hence, define ampere (the base SI unit of current) and hence, coulomb; from Q = It. Lorentz force.

(c) Derive the expression for torque on a current carrying loop placed in a uniform $\vec{B}$, using $\vec{F} = I\vec{l} \times \vec{B}$ and $\vec{\tau} = \vec{r} \times \vec{F}$; $\tau = NIAB \sin\phi$ for N turns $\vec{\tau} = \vec{m} \times \vec{B}$, where the dipole moment $\vec{m} = NI\vec{A}$, unit: $A.m^2$. A current carrying loop is a magnetic dipole; directions of current and $\vec{B}$ and $\vec{m}$ using right hand rule only; no other rule necessary. Mention orbital magnetic moment of an electron in Bohr model of H atom. Concept of radial magnetic field. Moving coil galvanometer; construction, principle, working, theory $I = k\phi$, current and voltage sensitivity. Shunt. Conversion of galvanometer into ammeter and voltmeter of given range.

(d) Magnetic field represented by the symbol $\vec{B}$ is now defined by the equation $\vec{F} = q_o (\vec{v} \times \vec{B})$; $\vec{B}$ is not to be defined in terms of force acting on a unit pole, etc.; note the distinction of $\vec{B}$ from $\vec{E}$ is that $\vec{B}$ forms closed loops as there are no magnetic monopoles, whereas $\vec{E}$ lines start from +ve charge and end on -ve charge. Magnetic field lines due to a magnetic dipole (bar magnet). Magnetic field in end-on and broadside-on positions (No derivations). Magnetic flux $\phi = \vec{B} . \vec{A} = BA$ for B uniform and $\vec{B} \parallel \vec{A}$; i.e. area held perpendicular to For $\phi = BA(\vec{B} \parallel \vec{A})$, $B = \phi/A$ is the flux density [SI unit of flux is weber (Wb)]; but note that this is not correct as a defining equation as $\vec{B}$ is vector and ϕ and ϕ/A are scalars, unit of B is tesla (T) equal to 10^{-4} gauss. For non-uniform $\vec{B}$ field, $\phi = \int d\phi = \int \vec{B} . d\vec{A}$.

(e) Properties of diamagnetic, paramagnetic and ferromagnetic substances; their susceptibility and relative permeability.

It is better to explain the main distinction, the cause of magnetization (M) is due to magnetic dipole moment (m) of atoms, ions or molecules being 0 for dia, >0 but very small for para and > 0 and large for ferromagnetic materials; few examples; placed in external $\vec{B}$, very small (induced) magnetization in a direction opposite to $\vec{B}$ in dia, small magnetization parallel to $\vec{B}$ for para, and large magnetization parallel to $\vec{B}$ for ferromagnetic materials; this leads to lines of $\vec{B}$ becoming less dense, more dense and much more dense in dia, para and ferro, respectively; hence, a weak repulsion for dia, weak attraction for para and strong attraction for ferro magnetic material. Also, a small bar suspended in the horizontal plane becomes perpendicular to the $\vec{B}$ field for dia and parallel to $\vec{B}$

for para and ferro. Defining equation H = (B/μ_0)-M; the magnetic properties, susceptibility χ_m = (M/H) < 0 for dia (as M is opposite H) and >0 for para, both very small, but very large for ferro; hence relative permeability μ_r =(1+ χ_m) < 1 for dia, > 1 for para and >>1 (very large) for ferro; further, $\chi_m \propto 1/T$ (Curie's law) for para, independent of temperature (T) for dia and depends on T in a complicated manner for ferro; on heating ferro becomes para at Curie temperature. Electromagnet: its definition, properties and factors affecting the strength of electromagnet; selection of magnetic material for temporary and permanent magnets and core of the transformer on the basis of retentivity and coercive force [B-H loop and its significance, retentivity and coercive force (Qualitative only)].

4. Electromagnetic Induction and Alternating Currents

(i) Electromagnetic Induction

Faraday's laws, induced emf and current; Lenz's Law, eddy currents. Self-induction and mutual induction. Transformer.

(ii) Alternating Current

Peak value, mean value and RMS value of alternating current/voltage; their relation in sinusoidal case; reactance and impedance; LC oscillations (qualitative treatment only), LCR series circuit, resonance; power in AC circuits, wattless current. AC generator.

(a) Electromagnetic induction, Magnetic flux, change in flux, rate of change of flux and induced emf; Faraday's laws. Lenz's law, conservation of energy; motional emf $\varepsilon = Blv$, and power $P = (Blv)^2/R$; eddy currents (qualitative);

(b) Self-Induction, coefficient of self-inductance, $\phi = LI$ and $L = \varepsilon / (dI/dt)$; henry = volt. Second/ampere, expression for coefficient of self-inductance of a solenoid $L = \frac{\mu_0 N^2 A}{l} = \mu_0 n^2 A \times l$.

Mutual induction and mutual inductance (M), flux linked $\phi_2 = MI_1$; induced emf $\varepsilon_2 = \frac{d\phi_2}{dt} = M\frac{dI_1}{dt}$. Definition of M as $M = \varepsilon_2 / \frac{dI_1}{dt}$ or $M = \phi_2 / I_1$. SI unit henry. Expression for coefficient of mutual inductance of two coaxial solenoids.

$M = \frac{\mu_0 N_1 N_2 A}{l} = \mu_0 n_1 N_2 A$ *Induced emf opposes changes, back emf is set up, eddy currents.*

Transformer (ideal coupling): principle, working and uses; step up and step down; efficiency and applications including transmission of power, energy losses and their minimisation.

(c) Sinusoidal variation of V and I with time, for the output from an ac generator; time period, frequency and phase changes; obtain mean values of current and voltage, obtain relation between RMS value of V and I with peak values in sinusoidal cases only.

(d) Variation of voltage and current in a.c. circuits consisting of only a resistor, only an inductor and only a capacitor (phasor representation), phase lag and phase lead. May apply Kirchhoff's law and obtain simple differential equation (SHM type), V = Vo sin ωt, solution $I = I_0 \sin \omega t$, $I_0 \sin(\omega t + \pi/2)$ and $I_0 \sin(\omega t - \pi/2)$ for pure R, C and L circuits respectively. Draw phase (or phasor) diagrams showing voltage and current and phase lag or lead, also showing resistance R, inductive reactance X_L; ($X_L = \omega L$) and capacitive reactance X_C, ($X_C = 1/\omega C$). Graph of X_L and X_C vs f.

(e) The LCR series circuit: Use phasor diagram method to obtain expression for I and V, the pd across R, L and C; and the net phase lag/lead; use the results of 4(e), V lags I by $\pi/2$ in a capacitor, V leads I by $\pi/2$ in an inductor, V and I are

in phase in a resistor, I is the same in all three; hence draw phase diagram, combine V_L and Vc (in opposite phase; phasors add like vectors) to give $V=V_R+V_L+V_C$ (phasor addition) and the max. values are related by $V^2_m=V^2_{Rm}+(V_{Lm}-V_{Cm})^2$ when $V_L>V_C$ Substituting pd=current x resistance or reactance, we get $Z^2=R^2+(X_L-X_c)^2$ and $\tan\phi = (V_{L\ m} - V_{Cm})/V_{Rm} = (X_L-X_c)/R$ giving $I = I_m \sin(wt-\phi)$ where $I_m = V_m/Z$ etc. Special cases for RL and RC circuits. [May use Kirchoff's law and obtain the differential equation] Graph of Z vs f and I vs f.

(f) Power P associated with LCR circuit = $^1/_2 V_o I_o \cos\phi = V_{rms} I_{rms} \cos\phi = I_{rms}^2 R$; power absorbed and power dissipated; electrical resonance; bandwidth of signals and Q factor (no derivation); oscillations in an LC circuit ($\omega_0 = 1/\sqrt{LC}$). Average power consumed averaged over a full cycle $\overline{P} = (1/2) V_o I_o \cos\phi$, Power factor $\cos\phi = R/Z$. Special case for pure R, L and C; choke coil (analytical only), X_L controls current but $\cos\phi = 0$, hence $\overline{P} = 0$, wattless current; LC circuit; at resonance with $X_L=X_c$, $Z=Z_{min}= R$, power delivered to circuit by the source is maximum, resonant frequency $f_0 = \frac{1}{2\pi\sqrt{LC}}$.

(g) Simple a.c. generators: Principle, description, theory, working and use. Variation in current and voltage with time for a.c. and d.c. Basic differences between a.c. and d.c.

5. Electromagnetic Waves

Basic idea of displacement current. Electromagnetic waves, their characteristics, their transverse nature (qualitative ideas only). Complete electromagnetic spectrum starting from radio waves to gamma rays: elementary facts of electromagnetic waves and their uses.

Concept of displacement current, qualitative descriptions only of electromagnetic spectrum; common features of all regions of electromagnetic spectrum including transverse nature ($\vec{E}$ and $\vec{B}$ perpendicular to $\vec{c}$); special features of the common classification (gamma rays, X rays, UV rays, visible light, IR, microwaves, radio and TV waves) in their production (source), detection and other properties; uses; approximate range of λ or f or at least proper order of increasing f or λ.

6. Optics

(i) Ray Optics and Optical Instruments

Ray Optics**:** Reflection of light by spherical mirrors, mirror formula, refraction of light at plane surfaces, total internal reflection and its applications, optical fibres, refraction at spherical surfaces, lenses, thin lens formula, lens maker's formula, magnification, power of a lens, combination of thin lenses in contact, combination of a lens and a mirror, refraction and dispersion of light through a prism.

Optical instruments: Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.

(a) Reflection of light by spherical mirrors. Mirror formula: its derivation; R=2f for spherical mirrors. Magnification.

(b) Refraction of light at a plane interface, Snell's law; total internal reflection and critical angle; total reflecting prisms and optical fibers. Total reflecting prisms: application to triangular prisms with angle of the prism 30^0, 45^0, 60^0 and 90^0 respectively; ray diagrams for Refraction through a combination of media, $_1n_2 \times {}_2n_3 \times {}_3n_1 = 1$, real depth and apparent depth. Simple applications.

(c) Refraction through a prism, minimum deviation and derivation of relation between n, A and δ_{min}. Include explanation of i-δ graph, $i_1 = i_2 = i$ (say) for δ_m; from symmetry $r_1 = r_2$; refracted ray inside the prism is parallel to the base of the equilateral prism. Thin prism.

Dispersion; *Angular dispersion; dispersive power, rainbow - ray diagram (no derivation). Simple explanation.*

(d) Refraction at a single spherical surface; detailed discussion of one case only - convex towards rarer medium, for spherical surface and real image. Derive the relation between n_1, n_2, u, v and R. Refraction through thin lenses: derive lens maker's formula and lens formula; derivation of combined focal length of two thin lenses in contact. Combination of lenses and mirrors (silvering of lens excluded) and magnification for lens, derivation for biconvex lens only; extend the results to biconcave lens, plano convex lens and lens immersed in a liquid; power of a lens P=1/f with SI unit dioptre. For lenses in contact $1/F= 1/f_1+1/f_2$ and $P=P_1+P_2$. Lens formula, formation of image with combination of thin lenses and mirrors.

[Any one sign convention may be used in solving numericals].

(e) Ray diagram and derivation of magnifying power of a simple microscope with image at D (least distance of distinct vision) and infinity; Ray diagram and derivation of magnifying power of a compound microscope with image at D. Only expression for magnifying power of compound microscope for final image at infinity.

Ray diagrams of refracting telescope with image at infinity as well as at D; simple explanation; derivation of magnifying power; Ray diagram of reflecting telescope with image at infinity. Advantages, disadvantages and uses. Resolving power of compound microscope.

(ii) Wave Optics

Wave front and Huygen's principle. Proof of laws of reflection and refraction using Huygen's principle. Interference, Young's double slit experiment and expression for fringe width(β), coherent sources and sustained interference of light, Fraunhofer diffraction due to a single slit, width of central maximum.

(a) Huygen's principle: wavefronts - different types/shapes of wavefronts; proof of laws of reflection and refraction using Huygen's theory. [Refraction through a prism and lens on the basis of Huygen's theory not required].

(b) Interference of light, interference of monochromatic light by double slit. Phase of wave motion; superposition of identical waves at a point, path difference and phase difference; coherent and incoherent sources; interference: constructive and destructive, conditions for sustained interference of light waves [mathematical deduction of interference from the equations of two progressive waves with a phase difference is not required]. Young's double slit experiment: set up, diagram, geometrical deduction of path difference $\Delta x = d\sin\theta$, between waves from the two slits; using $\Delta x=n\lambda$ for bright fringe and $\Delta x= (n+½)\lambda$ for dark fringe and $\sin\theta = \tan\theta = y_n/D$ as y and θ are small, obtain $y_n=(D/d)n\lambda$ and fringe width $\beta=(D/d)\lambda$. Graph of distribution of intensity with angular distance.

(c) Single slit Fraunhofer diffraction (elementary explanation, qualitative treatment only). Diffraction at a single slit: experimental setup, diagram, diffraction pattern, obtain expression for position of minima, $a\sin\theta_n= n\lambda$, where $n = 1,2,3\ldots$ and conditions for secondary maxima, $a\sin\theta_n =(n+½)\lambda$.; distribution of intensity with angular distance; angular width of central bright fringe.

7. Dual Nature of Radiation and Matter

Wave particle duality; photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation - particle nature of light. Matter waves - wave nature of particles, de-Broglie relation; conclusion from Davisson-Germer experiment (Qualitative only).

(a) Photo electric effect, quantization of radiation; Einstein's equation

$E_{max} = h\upsilon - W_0$; threshold frequency; work function; experimental facts of Hertz and Lenard and their conclusions; Einstein used Planck's ideas and extended it to apply for radiation (light); photoelectric effect can be explained only assuming quantum (particle) nature of radiation. Determination of Planck's constant (from the graph of stopping potential V_s versus frequency f of the incident light). Momentum of photon $p=E/c=h\nu/c=h/\lambda$.*

(b) De Broglie hypothesis, phenomenon of electron diffraction (qualitative only). Wave nature of radiation is exhibited in interference, diffraction and polarisation; particle nature is exhibited in photoelectric effect. Dual nature of matter: particle nature common in that it possesses momentum p and kinetic energy KE. The wave nature of matter was proposed by Louis de Broglie, $\lambda=h/p= h/mv$. Davisson and Germer experiment; qualitative description of the experiment and conclusion.

8. Atoms and Nuclei

(i) Atoms

Alpha-particle scattering experiment; Rutherford's atomic model; Bohr's atomic model, energy levels, hydrogen spectrum.

Rutherford's nuclear model of atom (mathematical theory of scattering excluded), based on Geiger - Marsden experiment on α-scattering; nuclear radius r in terms of closest approach of α particle to the nucleus, obtained by equating $\Delta K=\frac{1}{2} mv^2$ of the α particle to the change in electrostatic potential energy ΔU of the system [$U=\frac{2e\times Ze}{4\pi\varepsilon_0 r_0}$ $r_0 \sim 10^{-15}$m = 1 fermi; atomic structure; only general qualitative ideas, including atomic number Z, Neutron number N and mass number A. A brief account of historical background leading to Bohr's theory of hydrogen spectrum; formulae for wavelength in Lyman, Balmer, Paschen, Brackett and Pfund series. Rydberg constant. Bohr's model of H atom, postulates (Z=1); expressions for orbital velocity, kinetic energy, potential energy, radius of orbit and total energy of electron. Energy level diagram, calculation of ΔE, frequency and wavelength of different lines of emission spectra; agreement with experimentally observed values. [Use nm and not Å for unit of λ].

(ii) Nuclei

Composition and size of nucleus. Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number; Nuclear reactions, nuclear fission and nuclear fusion.

(a) Atomic masses and nuclear density; Isotopes, Isobars and Isotones – definitions with examples of each. Unified atomic mass unit, symbol u, 1u=1/12 of the mass of ^{12}C atom = $1.66\text{x}10^{-27}$kg). Composition of nucleus; mass defect and binding energy, BE= $(\Delta m)\, c^2$. Graph of BE/nucleon versus mass number A, special features - less BE/nucleon for light as well as heavy elements. Middle order more stable [see fission and fusion] Einstein's equation $E=mc^2$. Calculations related to this equation; mass defect/binding energy, mutual annihilation and pair production as examples.

(b) Nuclear Energy

Theoretical (qualitative) prediction of exothermic (with release of energy) nuclear reaction, in fusing together two light nuclei to form a heavier nucleus and in splitting heavy nucleus to form middle order (lower mass number) nuclei, is evident from the shape of BE per nucleon versus mass number graph. Also calculate the disintegration energy Q for a heavy nucleus (A=240) with BE/A ~ 7.6 MeV per nucleon split into two equal halves with A=120 each and BE/A ~ 8.5 MeV/nucleon; Q ~ 200 MeV. Nuclear fission: Any one equation of fission reaction. Chain reaction-controlled and uncontrolled; nuclear reactor and nuclear bomb. Main parts of a nuclear reactor including their functions - fuel elements, moderator,

control rods, coolant, casing; criticality; utilization of energy output - all qualitative only. Fusion, simple example of 4 $^{1}H \rightarrow {}^{4}He$ and its nuclear reaction equation; requires very high temperature ~ 10^{6} degrees; difficult to achieve; hydrogen bomb; thermonuclear energy production in the sun and stars. [Details of chain reaction not required].

9. Electronic Devices

(i) Semiconductor Electronics: Materials, Devices and Simple Circuits. Energy bands in conductors, semiconductors and insulators (qualitative ideas only). Intrinsic and extrinsic semiconductors. P and n type, p-n junction.

(ii) Semiconductor diode: I-V characteristics in forward and reverse bias, diode as a rectifier; Special types of junction diodes: LED, photodiode and solar cell and Zener diode and its characteristics, Zener diode as a voltage regular.

(a) Energy bands in solids; energy band diagrams for distinction between conductors, insulators and semi-conductors - intrinsic and extrinsic; electrons and holes in semiconductors.

Elementary ideas about electrical conduction in metals [crystal structure not included]. Energy levels (as for hydrogen atom), 1s, 2s, 2p, 3s, etc. of an isolated atom such as that of copper; these split, eventually forming 'bands' of energy levels, as we consider solid copper made up of a large number of isolated atoms, brought together to form a lattice; definition of energy bands - groups of closely spaced energy levels separated by band gaps called forbidden bands. An idealized representation of the energy bands for a conductor, insulator and semiconductor; characteristics, differences; distinction between conductors, insulators and semiconductors on the basis of energy bands, with examples; qualitative discussion only; energy gaps (eV) in typical substances (carbon, Ge, Si); some electrical properties of semiconductors. Majority and minority charge carriers - electrons and holes; intrinsic and extrinsic, doping, p-type, n-type; donor and acceptor impurities.

(b) Junction diode and its symbol; depletion region and potential barrier; forward and reverse biasing, V-I characteristics and numericals; half wave and a full wave rectifier. Simple circuit diagrams and graphs, function of each component in the electric circuits, qualitative only. [Bridge rectifier of 4 diodes not included]; elementary ideas on solar cell, photodiode and light emitting diode (LED) as semi conducting diodes. Importance of LED's as they save energy without causing atmospheric pollution and global warming. Zener diode, V-I characteristics, circuit diagram and working of Zener diode as a voltage regulator.

PAPER II

PRACTICAL WORK- 15 Marks

The experiments for laboratory work and practical examinations are mostly from two groups: (i) experiments based on ray optics and (ii) experiments based on current electricity.

The main skill required in group (i) is to remove parallax between a needle and the real image of another needle.

In group (ii), understanding circuit diagram and making connections strictly following the given diagram is very important. Polarity of cells and meters, their range, zero error, least count, etc. should be taken care of.

A graph is a convenient and effective way of representing results of measurement. It is an important part of the experiment.

There will be one graph in the Practical question paper.

Candidates are advised to read the question paper carefully and do the work according to the instructions given in the question paper. Generally they are not expected to write the procedure of the experiment, formulae, precautions, or draw the figures, circuit diagrams, etc.

Observations should be recorded in a tabular form.

Record of observations

- All observations recorded should be consistent with the least count of the instrument used (e.g.

focal length of the lens is 10.0 cm or 15.1cm but **10 cm is a wrong record.)**

- All observations should be recorded with correct units.

Graph work

Students should learn to draw graphs correctly noting all important steps such as:

(i) Title

(ii) Selection of origin (should be marked by two coordinates, example 0,0 or 5,0, or 0,10 or 30,5; **Kink is not accepted).**

(i) The axes should be labelled according to the question

(ii) Uniform and convenient scale should be taken and the units given along each axis (one small division = 0.33, 0.67, 0.66, etc. should not to be taken)

(iii) Maximum area of graph paper (**at least 60% of the graph paper along both the axes**) should be used.

(iv) Points should be plotted with great care, marking the points plotted with (should be a circle with a dot) ⊙ or ⊗. A blob (●) is a misplot.

(v) The best fit straight line should be drawn. The best fit line does not necessarily have to pass through all the plotted points and the origin. While drawing the best fit line, **all experimental points must be kept on the line or symmetrically placed on the left and right side of the line.** The line should be continuous, thin, uniform and extended beyond the extreme plots.

(vi) The intercepts must be read carefully. Y intercept i.e. y_0 is that value of y when x = 0. Similarly, X intercept i.e. x_0 is that value of x when y=0. **When x_0 and y_0 are to be read, origin should be at (0, 0).**

Deductions

(i) The slope 'S' of the best fit line must be found taking two distant points **(using more than 50% of the line drawn), which are not the plotted points**, using $S = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x}$. Slope S must be calculated upto proper decimal place or significant figures as specified in the question paper.

(ii) All calculations should be rounded off upto proper decimal place or significant figures, as specified in the question papers.

NOTE:

Short answer type questions may be set from each experiment to test understanding of theory and logic of steps involved.

Given below is a list of required experiments. Teachers may add to this list, keeping in mind the general pattern of questions asked in the annual examinations.

Students are required to have completed all experiments from the given list (excluding demonstration experiments):

1. To find focal length of a convex lens by using u-v method (no parallax method)

   Using a convex lens, optical bench/metre scales and two pins, obtain the positions of the images for various positions of the object; f<u<2f, u~2f, and u>2f.

   Draw the following set of graphs using data from the experiments -

   (i) v against u. It will be a curve.

   (ii) Magnification $\left(m = \frac{v}{u}\right)$ against v which is a straight line and to find focal length by intercept.

   (iii) y = (100/v) against x = (100/u) which is a straight line and find f by intercepts.

2. To find f of a convex lens by displacement method.

3. To determine the focal length of a given convex lens with the help of an auxiliary convex lens.

4. To determine the focal length of a concave lens, using an auxiliary convex lens, not in contact and plotting appropriate graph.

5. To determine focal length of concave mirror by using two pins (by u-v method).

6. To determine the refractive index of a liquid by using a convex lens and a plane mirror.

7. To determine the focal length of a convex mirror using convex lens.
8. Using a metre bridge, determine the resistance of about 100 cm of (constantan) wire. Measure its length and radius and hence, calculate the specific resistance of the material.Verify Ohm's law for the given unknown resistance (a 60 cm constantan wire), plotting a graph of potential difference versus current. Also calculate the resistance per cm of the wire from the slope of the graph and the length of the wire.
9. To determine the internal resistance of a cell by a potentiometer.
10. From a potentiometer set up, measure the fall in potential (i.e. pd) for increasing lengths of a constantan wire, through which a steady current is flowing; plot a graph of pd (V) versus length (l). Calculate the potential gradient of the wire and specific resistance of its material. Q (i) Why is the current kept constant in this experiment? Q (ii) How can you increase the sensitivity of the potentiometer? Q (iii) How can you use the above results and measure the emf of a cell?
11. To verify the laws of combination of resistances (series and parallel) using metre bridge.

Demonstration Experiments *(The following experiments are to be demonstrated by the teacher)*:

1. To convert a given galvanometer into (a) an ammeter of range, say 2A and (b) a voltmeter of range 4V.
2. To study I-V characteristics of a semi-conductor diode in forward and reverse bias.
3. To determine refractive index of a glass slab using a traveling microscope.
4. Identification of diode, LED, transistor, IC, resistor, capacitor from mixed collection of such items.
5. Use of multimeter to (i) identify base of transistor, (ii) distinguish between npn and pnp type transistors, (iii) see the unidirectional flow of current in case of diode and an LED, (iv) check whether a given electronic component (e.g. diode, transistors, IC) is in working order.
6. Charging and discharging of a capacitor.

PROJECT WORK AND PRACTICAL FILE – 15 marks

Project Work – 10 marks

The Project work is to be assessed by a Visiting Examiner appointed locally and approved by the Council.

All candidates will be required to do **one** project involving some physics related topic/s under the guidance and regular supervision of the Physics teacher.

Candidates should undertake any **one** of the following types of projects:

- Theoretical project
- Working Model
- Investigatory project (by performing an experiment under supervision of a teacher)

Candidates are to prepare a technical report including title, abstract, some theoretical discussion, experimental setup, observations with tables of data collected, graph/chart (if any), analysis and discussion of results, deductions, conclusion, etc. The teacher should approve the draft, before it is finalised. The report should be kept simple, but neat and elegant. Teachers may assign or students may choose **any one** project of their choice.

Suggested Evaluation Criteria for Theory Based Projects:

▪ Title of the Project
▪ Introduction
▪ Contents
▪ Analysis/ material aid (graph, data, structure, pie charts, histograms, diagrams, etc.)
▪ Originality of work (the work should be the candidates' original work,)
▪ Conclusion/comments

Suggested Evaluation Criteria for Model Based Projects:

▪ Title of the Project
▪ Model construction
▪ Concise Project report

Suggested Evaluation Criteria for Investigative Projects:

▪ Title of the Project
▪ Theory/principle involved
▪ Experimental setup
▪ Observations calculations/deduction and graph work
▪ Result/ Conclusions

Practical File – 5 marks

The Visiting Examiner is required to assess the candidates on the basis of the Physics practical file maintained by them during the academic year.

CHEMISTRY (862)

CLASS XI

There will be two papers in the subject:

Paper I: *Theory- 3 hours ... 70 marks*

Paper II: *Practical - 3 hours ... 15 marks*
Project Work ... 10 marks
Practical File ... 5 marks

PAPER 1- THEORY: 70 Marks

S.No.	UNIT	TOTAL WEIGHTAGE
1.	Some Basic Concepts of Chemistry	**Physical Chemistry 41 Marks**
2.	Structure of Atom	
3.	Classification of Elements and Periodicity in Properties	
4.	Chemical Bonding and Molecular Structure	
5.	Chemical Thermodynamics	
6.	Equilibrium	
7.	Redox Reactions	**Inorganic Chemistry 6 Marks**
8.	Organic Chemistry: Some basic Principles and Techniques	**Organic Chemistry 23 Marks**
9.	Hydrocarbons	
	TOTAL	**70 Marks**

PAPER I –THEORY – 70 Marks

1. Some Basic Concepts of Chemistry

General introduction: Importance and scope of chemistry.

Study of matter. Understanding laws of chemical combination. Dalton's atomic theory: concept of elements, atoms and molecules.

Isotopic (atomic) and molecular masses, mole concept and molar mass, percentage composition, empirical and molecular formula. Stoichiometry and calculations based on chemical reactions.

(i) Precision and accuracy:

Quantities and their measurements in Chemistry, significant figures, SI units.

(ii) Dimensional analysis:

Conversion of units, numericals and applications of units.

(iii) The concept of atoms having fixed properties in explaining the laws of chemical combination.

Study about atoms. Dalton's atomic theory: Main postulates of the theory; its limitations.

Laws of chemical combinations:

- *Law of conservation of mass.*
- *Law of definite proportions.*
- *Law of multiple proportions.*
- *Law of reciprocal proportions.*
- *Gay Lussac's law of gaseous volumes.*

Statement, explanation and simple problems based on these laws.

(iv) Atomic (isotopic masses) and molecular mass.

Relative molecular mass and mole:

The atomic mass unit is one of the experimentally determined unit. It is equal to 1/12 of the mass of the carbon 12 isotope.

Numerical problems based on mole concept, Avogadro's number and gram molecular volume.

(v) Empirical and molecular formula: Numericals based on the above.

(vi) Chemical equivalents, volumetric calculations in terms of normality. C = 12.00 should be taken as a standard for expressing atomic masses.

Equivalent weight expressing the combining capacity of the elements with the standard elements such as H, Cl, O, Ag, etc.

Variable equivalent weight. Gram equivalent weights, relationship between gram equivalent weight, gram molecular mass and valency.

Determination of equivalent weight of acids, alkalis, salts, oxidising and reducing agents. (experimental details not required).

Terms used in volumetric calculations such as percentage (w/w and w/v), normality, molarity, molality, mole fraction, etc. should be discussed. Students are required to know the formulae and normality and molarity equations.

Simple calculations on the above topics.

(vii) Chemical reactions – stoichiometric calculations based on mass-mass, mass-volume, volume-volume relationships and limiting reagent.

2. Structure of Atom

Discovery of fundamental particles electron, proton and neutron), atomic number, isotopes and isobars. Thomson's model and its limitations. Rutherford's experimental model and its limitations. Dual nature of matter and light. Bohr's atomic model and its limitations (de Broglie's equation, Heisenberg's uncertainty principle), concept of shells, subshells, orbitals. Quantum numbers, shapes of s, p and d orbitals. Rules for filling electrons in orbitals - aufbau principle, Pauli's exclusion principle and Hund's rule of maximum multiplicity. Electronic configuration of atoms, stability of half- filled and completely filled orbitals.

(i) Subatomic particles (electrons, protons and neutrons) their charges and masses: Concept of indivisibility of atom as proposed by Dalton does not exist. The atom consists of subatomic fundamental particles. Production of cathode rays and their properties. Production of anode rays and their properties.

Chadwick's experiment for the discovery of neutron and properties of neutron.

(ii) Rutherford's nuclear model based on the scattering experiment: Rutherford's scattering experiment. Discovery of nucleus. Rutherford's nuclear model of atom. Defects of Rutherford's model. Electromagnetic wave theory and its limitations (Black body radiation and photoelectric effect)

Planck's quantum theory.

Numericals based on the above.

(iii) Types of spectra: emission and absorption spectra. Band and line spectra to be discussed.

(iv) Bohr's atomic model.

Postulates of Bohr's theory – based on Planck's quantum theory.

Merits of Bohr's atomic model and explanation of hydrogen spectra.
Calculations based on Rydberg's formula.

Numericals on Bohr's atomic radii, velocity and energy of orbits (derivation not required).

Defects in Bohr's Model.

(v) Quantum mechanical model of an atom - a simple mathematical treatment. Quantum numbers; shape, size and orientation of s, p and d orbitals only (no derivation). aufbau principle, Pauli's exclusion principle, Hund's rule of maximum multiplicity. Electronic configuration of elements in terms of s, p, d, f subshells.

- *de Broglie's equation. Numericals.*
- *Heisenberg's Uncertainty Principle. Numericals.*
- *Schrodinger Wave Equation – physical significance of Ψ and $|\Psi|^2$.*
- *Quantum numbers – types of quantum numbers, shape, size and orientation of the s, p and d subshells. Information obtained in terms of distance of electron from the nucleus, node, nodal planes and radial probability curve, energy of electron, number of electrons present in an orbit and an orbital.*
- *aufbau principle, (n+l) rule.*
- *Pauli's exclusion principle.*
- *Hund's rule of maximum multiplicity.*
- *Electronic configuration of elements and ions in terms of s, p, d, f subshells and stability of half-filled and completely filled orbitals.*

3. Classification of Elements and Periodicity in Properties

Significance of classification; study of Mendeleev's periodic law and its limitations; Modern Periodic Law and the present form of periodic table leading to periodic trends in properties of elements - atomic radii, ionic radii, valency, ionisation enthalpy, electron gain enthalpy, electronegativity. Nomenclature of elements with atomic number greater than 100.

(i) Modern Periodic Law

Mendeleev's periodic law, defects in the Mendeleev's periodic table. Advantages and disadvantages. Modern periodic law (atomic number taken as the basis of classification of the elements).

(ii) Long form of Periodic Table.

General characteristics of groups and periods. Division of periodic table as s, p, d and f blocks. IUPAC nomenclature for elements with Z> 100.

(iii)Periodic trends in properties of elements.

Atomic radius, ionic radius, ionisation enthalpy, electron gain enthalpy, electronegativity, metallic and non-metallic characteristics.

- *Periodic properties such as valence electrons, atomic and ionic radii and their variation in groups and periods.*
- *The idea of ionisation enthalpy, electron gain enthalpy and electronegativity must be given and their variation in groups and periods may be discussed.*
- *The factors (atomic number, screening effect and shielding effect, the number of electrons in the outermost orbit) which affect these periodic properties and their variation in groups and periods.*

(iv) Periodic trends in chemical properties – periodicity of valence or oxidation states. Anomalous properties of second period elements.

Diagonal relationship; acidic and basic nature of oxides.

***NOTE:** Recommendations of the latest IUPAC for numbering of groups to be followed. Numbering 1 – 18 replacing old notation of I – VIII. Details given at the end of the syllabus.*

4. Chemical Bonding and Molecular structure

Valence electrons, ionic bond character, covalent bond of ionic bond, covalent bond, bond parameters, lewis structure, polar character of covalent bond, VSEPR theory, geometry of covalent molecules, valence bond theory, concept of hybridisation involving s, p and d orbitals and shapes of some simple molecules. Coordinate bond. Molecular orbital theory of homonuclear diatomic molecules (qualitative idea only). Resonance and hydrogen bond.

(i) Kossel-Lewis approach to chemical bonding. Octet rule, its application to electrovalent and covalent bonds.

(ii) Electrovalent or ionic bond: Lewis structures of NaCl, Li_2O, MgO, CaO, MgF_2, and Na_2S.

Definition of ionic bond.

The conditions necessary for the formation of ionic bonds such as:

- *low ionisation enthalpy of metals.*
- *high electron gain enthalpy of non-metals.*
- *high lattice energy.*
- *electronegativity difference between the reacting atoms.*

All these points must be discussed in detail.

The formation of cations and anions of elements and their positions in the periodic table.

Variable electrovalency; reasons for variable electrovalency i.e, due to inert electron pair effect and unstable core, by using suitable examples.

Calculation of lattice enthalpy (Born-Haber cycle).

Characteristics of electrovalent bond.

(iii) Covalent Bond – Bond parameters, Lewis structure, polar character of covalent bond, shapes.

Sigma and pi bonds e.g. formation of ammonia, nitrogen, ethene, ethyne, and carbon dioxide.

Definition of covalent bond, conditions for formation of covalent bonds, types of covalent bonds, i.e single, double and triple bonds. Sigma and pi bonds: H_2, O_2, N_2.

Classification of covalent bonds based on electronegativity of atoms - polar and non-polar covalent bond, dipole moment.

Formation of CH_4, NH_3, H_2O, ethane, ethene, ethyne and CO_2, etc. and their electron dot structure or Lewis structure.

Characteristics of covalent compounds.

Comparison in electrovalency and covalency.

Reason for variable covalency e.g. Phosphorus 3 & 5 and sulphur 2, 4, 6 & chlorine 1, 3, 5 and 7.

Formal charge of ions.

(iv) Deviation from octet rule and Fajan's rules.

Definition of octet rule.

Failure of octet rule, due to either incomplete octet or exceeding of octet with suitable examples.

Fajan's rules: statements, conditions for electrovalency and covalency. Polar and non polar bonds should be correlated with Fajan's rules.

(v) Valence Shell Electron Pair Repulsion (VSEPR) Theory; Hybridisation and shapes of molecules: hybridisation involving s, p and d orbitals only.

Concept of electron-pair repulsion and shapes of molecules using suitable examples.

Hybridisation and molecular shapes – definition, hybridisation of orbitals involving s, p and d orbitals (using suitable examples).

(vi) Molecular orbital theory: Qualitative treatment of homonuclear diatomic molecules of first two periods (hydrogen to neon), Energy level diagrams, bonding and antibonding molecular orbitals, bond order, paramagnetism of O_2 molecule. Relative stabilities of O_2, O_2^-, O_2^{2-}, O_2^+ and N_2, N_2^+, N_2^-, N_2^{2-}.

(vii) Co-ordinate or dative covalent bond, e.g. formation of oxy-acids of chlorine: Co-ordinate or dative covalent bonding: definition, formation of chlorous acid, chloric acid, perchloric acid, ammonium ion, hydronium ion, nitric acid, ozone.

(viii) Resonance in simple inorganic molecules: Resonance in simple inorganic molecules like ozone, carbon dioxide, carbonate ion and nitrate ion.

(ix) Hydrogen bonding: the examples of hydrogen fluoride, water (ice), alcohol, etc. may be considered.

H-bonding – definition, types, condition for hydrogen bond formation, examples of inter-molecular hydrogen bonding in detail taking hydrogen fluoride, water and ice and ethanol into account. Intramolecular hydrogen bonding.

5. Chemical Thermodynamics

(i) Introduction, concepts, types of system, surroundings, extensive, intensive properties and state functions.

Types of system – ideal system, real system, isolated system, closed system, open system. Meaning of surroundings.

Properties of the system: macroscopic, intensive and extensive properties.

State of the system.

Main processes the system undergoes: reversible, irreversible, adiabatic, isothermal, isobaric, isochoric, cyclic.

Meaning of thermodynamic equilibrium. Meaning of thermodynamic process.

(ii) First Law of Thermodynamics and its significance, work, heat, internal energy, enthalpy (ΔU or ΔE and ΔH), heat capacity and specific heat. Hess's law of constant heat summation, enthalpy of bond dissociation, combustion, formation, atomisation, sublimation, phase transition, ionisation, solution and dilution.

Meaning of: internal energy of the system, work done by the system, by the surroundings at constant temperature, heat absorbed by the system and by the surroundings at constant temperature.

The sign convention for change in internal energy, heat given out or gained, work done by the system or by the surroundings.

State function and path function - meaning with examples. Internal energy change, work done and heat absorbed in a cyclic process.

Internal energy change in an isolated system and in a non-isolated system. Total internal energy change of a system and surroundings. Mathematical statement of the first law.

Significance of first law of thermodynamics. Need for enthalpy – constant pressure or open vessel processes. Enthalpy - a thermodynamic property, state function. Mathematical form of enthalpy.

Heat - the energy in transit. Conditions for the transfer of heat. Limitations in conversion of heat into work. Condition at which heat transfer ceases, unit of heat.

Meaning of work, capacity to do work,types of work. Mathematical form of reversible work and irreversible work. Difference between the reversible and irreversible work done – graphically.

Relationship between C_v and internal energy change. Relationship between C_p and C_v.

Definitions of the following:

Heat of reaction: Heat of formation – standard heat of formation, Heat of solution, Heat of dilution, Heat of neutralization, Heat of combustion.

Constancy in the heat of neutralisation:

Experimental verification in case of strong acids and strong bases. Reason for that observation – ionic neutralisation and the heat evolved.

Definition of Calorific value of a fuel.

Statement of Hess' Law and its application.

Problems based on Hess' Law.

(iii) Second Law of Thermodynamics and its significance, spontaneity of a chemical change; Entropy, Free Energy. Inadequacy of First Law and need for Second Law; Ideas about reversible (recapitulation), spontaneous and non-spontaneous processes

Meaning of entropy – derived from Second Law – statement of Second Law in terms of entropy; Physical significance of entropy;

State function and not path function. Entropy change of the universe, reversible isothermal process and irreversible process.

Meaning of thermal death, Gibb's free energy of the system and Helmholtz free energy. Relationship between Gibb's free energy and Helmholtz's free energy.

Relationship between change in Gibb's free energy and equilibrium constant of a chemical reaction. Defining the criteria for spontaneity of a chemical change in terms of Gibb's free energy.

***Note:** Numericals based on the First Law, Second Law of Thermodynamics and Hess' Law.*

(iv)Third Law of Thermodynamics – statement only.

Self-explanatory.

6. Equilibrium

(i) Chemical Equilibrium.

Introduction of physical and chemical equilibrium and its characteristics

Dynamic nature of equilibrium, law of mass action, equilibrium constant and factors affecting equilibrium. Le Chatelier's principle and its applications.

Irreversible and reversible reactions.

Physical equilibrium: solid-liquid, liquid-vapour, solid-vapour; Characteristics of Physical equilibrium.

Chemical equilibrium: Characteristics of chemical equilibrium; dynamic nature. Law of mass action; Equilibrium constant in terms of concentration K_c. Gaseous reactions; Equilibrium constant in terms of partial pressures K_p. Relationship between K_p and K_c (derivation required); Characteristics of equilibrium constant; Units for equilibrium constant; Simple calculations of equilibrium constant and concentration.

The following examples should be considered to show maximum yield of products:

- *Synthesis of ammonia by Haber's process.*
- *The dissociation of dinitrogen tetra oxide.*
- *Hydrolysis of simple esters.*
- *The contact process for the manufacture of sulphuric acid.*

Le Chatelier's Principle. Statement and explanation.

Factors affecting chemical and physical equilibria should be discussed in the light of Le Chatelier's principle.

- *Change of concentration.*
- *Change of temperature.*
- *Change of pressure.*
- *Effect of catalyst.*
- *Addition of inert gas.*

(ii) Ionic equilibrium

Introduction, electrolyte (strong and weak), non-electrolyte, ionisation, degree of ionisation of polybasic acids, acid strength, concept of pH, pH indicators, buffer solution, common ion effect (with illustrative examples). Henderson equation, hydrolysis of salts, solubility and solubility product.

Ostwald's dilution law and its derivation. Strength of acids and bases based on their dissociation constant. Problems based on the Ostwald's dilution law.

Arrhenius, Brönsted-Lowry and Lewis concept of acids and bases, multistage ionisation of acids and bases with examples.

Ionic product of water – definition, pH, pOH, pK_w of solutions.

pH indicators and their choice in titrimetry.

Numericals on the above concepts.

Common ion effect – definition, examples (acetic acid and sodium acetate; ammonium hydroxide and ammonium chloride), applications in salt analysis.

Salt hydrolysis – salts of strong acids and weak bases, weak acids and strong bases, weak acids and weak bases and the pH formula of the solutions of these salts in water with suitable examples.

Buffer solutions: definition, examples, action; its interpretations based on Le Chatelier's principle. Henderson equation.

Solubility product: definition and application in qualitative salt analysis (Group II, III and IV cations).

Numericals on pH, buffer solutions, solubility and solubility product.

7. Redox Reactions

Concept of oxidation and reduction, redox reactions, oxidation number, change in oxidation number, balancing redox reactions (in terms of loss and gain of electrons). Applications of redox in various types of chemical reactions.

- *Concept of oxidation and reduction in terms of oxygen, hydrogen, electrons.*
- *Redox reactions – examples.*
- *Oxidation number: rules for calculation, simple calculations of oxidation state in molecules and ions like* $K_2\underline{Cr}_2O_7$, $\underline{S}_2O_3^{2-}$, *etc.*
- *Oxidation and reduction in terms of change in oxidation number.*
- *Balancing of redox reactions in acidic and basic medium by oxidation number and ion-electron method.*

8. Organic Chemistry - Some Basic Principles and Techniques

General introduction, classification and IUPAC nomenclature of organic compounds and isomerism.

Methods of purification, qualitative and quantitative analysis. Electron displacement in a covalent bond: inductive effect, electromeric effect, resonance and hyperconjugation.

Homolytic and heterolytic bond fission of a covalent bond: free radicals, carbocations, carbanions, electrophiles and nucleophiles, types of organic reactions.

(i) Introduction to organic chemistry:

Vital force theory, reason for separate study of organic chemistry and its importance, characteristics of carbon atoms (tetra valency), Reasons for large number of organic compounds: catenation, isomerism and multiple bonding, etc.

(ii) Classification of organic compounds: (definition and examples): open chain, closed chain, homocyclic, hetrocyclic, aromatic, alicyclic compounds, homologous series and its characteristics, functional groups.

(iii) IUPAC rules for naming organic compounds. Aliphatic, alicyclic and aromatic compounds.

(iv) Definition and classification of isomerism:

Structural isomerism: definition, classification, examples.

Chain isomerism, Positional isomerism, Functional isomerism, Metamerism, Tautomerism - examples for each of the above.

Stereoisomerism: definition and classification, examples.

Geometrical isomerism: Definition. Conditions for compounds to exhibit geometrical isomerism; types and examples, cis and trans, syn and anti. Examples.

Optical isomerism: Definition, Nicol prism, plane polarised light. polarimeter. Method of measuring angle of rotation. Specific rotation. Conditions for optical activity. d, l form; External compensation, Internal compensation, racemic mixture & meso form. Examples – lactic acid and tartaric acid.

(v) Analysis of organic compounds:

Detection of elements (qualitative analysis) such as carbon, hydrogen, nitrogen, halogens and sulphur should be considered by using Lassaigne's test and reactions involved in it.

(vi) Estimation of carbon, hydrogen, nitrogen, halogens, sulphur and phosphorous:

Estimation of carbon and hydrogen – Leibig's method.

Estimation of nitrogen - Kjeldahl's method.

Estimation of halogens sulphur and phosphorous - Carius method. Numericals included. Experimental details required.

(vii) Types of chemical reactions and their mechanisms.

Substitution, addition, elimination reactions: definition and examples.

Homolytic and heterolytic fission – definition and examples. Free radicals, carbocation, carbanion (their reactivities and stabilities).

Electrophiles and nucleophiles – definition and examples (including neutral electrophiles and nucleophiles).

Inductive, electromeric, mesomeric effect and hyperconjugation – definition, examples.

(viii) Free radicals and polar mechanisms

In terms of fission of the bonds and formation of the new bonds including S_N1, S_N2, E_1 and E_2 mechanisms. Explain with relevant examples and conditions.

9. Hydrocarbons

Classification of Hydrocarbons

I. Aliphatic Hydrocarbons

(i) Alkanes - Nomenclature, isomerism, conformation (methane and ethane), physical properties, chemical properties including free radical mechanism of halogenation, combustion and pyrolysis.

Occurrence, conformation (Sawhorse and Newman projections of ethane).

General methods of preparation: from sodium salts of carboxylic acids (decarboxylation and Kolbe's electrolytic method); from alcohols and alkyl halides (Wurtz reaction, Coreyhouse Synthesis). From aldehydes and Grignard's Reagent.

Physical and chemical properties of alkanes.

Physical properties: state, freezing point, melting point, boiling point, density.

Chemical properties: combustibility, reaction with chlorine (free radical mechanism), reaction with oxygen in presence of catalyst (formation of alcohol, aldehyde, and carboxylic acid). Cyclisation, aromatisation, isomerisation and pyrolysis.

Uses of alkanes.

(ii) Alkenes - Nomenclature, structure of double bond (ethene), isomerism; methods of preparation; physical properties, chemical properties; addition of hydrogen, halogen, water, hydrogen halides (Markownikoff's addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition.

General methods of preparation – dehydration of alcohols, dehydrohalogenation of alkyl halides (from vicinal dihalides), Kolbe's electrolytic method and from alkynes.

Physical Properties: State, freezing point, melting point, boiling point, dipole moment, density.

Chemical properties - addition reactions (hydrogen, halogens, hydrogen halides, sulphuric acid, water).

Markownikoff's rule and anti-Markownikoff's rule with mechanism and examples.

Oxidation: complete combustion, hot and cold alkaline $KMnO_4$ (Baeyer's reagent), ozonolysis.

Polymerisation.

Saytzeff's rule and its application.

Uses of alkenes.

(iii) Alkynes - Nomenclature, structure of triple bond (ethyne), methods of preparation; physical properties, chemical properties: acidic character of alkynes, addition reactions - hydrogen, halogens, hydrogen halides and water.

General methods of preparations of alkynes. Manufacture of ethyne by calcium carbide and from natural gas. Dehydrohalogenation and Kolbe's electrolytic method.

Physical properties of alkynes: State of existence, freezing point, melting point, boiling point, density.

Chemical properties of alkynes – addition reactions (hydrogen, halogens,

hydrogen halides and water), acidic nature of alkynes, formation of acetylides.

Oxidation: complete combustion, hot and cold alkaline $KMnO_4$ (Baeyer's reagent), ozonolysis.

Polymerisation.

Uses of alkynes.

Distinguishing test between Alkane, Alkene and Alkyne.

II. Aromatic Hydrocarbons

Introduction, IUPAC nomenclature, benzene: resonance, aromaticity, chemical properties: mechanism of electrophilic substitution. Nitration, sulphonation, halogenation, Friedel Crafts alkylation and acylation, directive influence of functional group in monosubstituted benzene. Carcinogenicity and toxicity.

Structure: Resonance structures (Kekule's) of benzene.

Benzene: Preparation from sodium benzoate and from phenol.

Physical properties: State of existence, freezing point, melting point, boiling point, density.

Chemical properties:

- *Electrophilic substitution reactions with mechanism (halogenation, nitration, sulphonation).*
- *Alkylation, acetylation – Friedel Crafts reaction.*
- *Directive influence (o-, p-, and m-) of substituents in electrophilic and nucleophilic substitutions (with mechanism).*
- *Oxidation: catalytic oxidation, reaction with ozone.*
- *Addition reactions with hydrogen, chlorine, bromine.*
- *Pyrolysis (formation of bi-phenyl).*

Carcinogenicity and toxicity of benzene may be discussed.

Uses.

PAPER II

PRACTICAL WORK- 15 Marks

Candidates are required to complete the following experiments:

1. Basic laboratory techniques:
   - Cutting a glass tube.
   - Bending a glass tube.
   - Drawing out a glass jet.
   - Boring a cork.
2. Titration: acid-base titration involving molarity.

   Titrations involving:

   - *Sodium carbonate solution/ dil H_2SO_4 or dil. HCl using methyl orange indicator.*
   - *NaOH or KOH solution/ dil H_2SO_4 or dil. HCl using methyl orange indicator.*
   - *Calculations involving molarity, concentration in grams L^{-1}/ number of ions, water of crystallisation and percentage purity.*

NOTE: Calculation of molarity must be upto 4 decimal places at least, in order to avoid error.

OBSERVATION TABLE

S. No.	(A)	(B)	(B – A)
	Initial burette reading (ml)	**Final burette reading (ml)**	**Difference (ml)**
1			
2			
3			

- Concordant reading is to be used for titre value. Concordant reading is two consecutive values which are exactly the same. Average will not be accepted as titre value.
- The table is to be completed in ink only. Pencil is not to be used.
- Overwriting will not be accepted in the tabular column.

Observations:

- Pipette size (should be same for all the candidates at the centre):
- Titre value (concordant).

3. Qualitative analysis: identification of single salt containing one anion and one cation:

   Anions: CO_3^{2-}, NO_2^-, S^{2-}, SO_3^{2-}, SO_4^{2-}, NO_3^-, CH_3COO^-, Cl^-, Br^-, I^-, $C_2O_4^{2-}$, PO_4^{3-}.

   Cations: NH_4^+, Pb^{2+}, Cu^{2+}, Al^{3+}, Fe^{3+}, Zn^{2+}, Mn^{2+} Ni^{2+}, Co^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}.

   Anions: Dilute acid group – CO_3^{2-}, NO_2^-, S^{2-}, SO_3^{2-}

   Concentrated Acid Group – NO_3^-, Cl^-, Br^-, I^-, CH_3COO^-.

   Special Group - SO_4^{2-}, PO_4^{3-}, *$C_2O_4^{2-}$.*

   Cations: Group Zero: NH_4^+

   Group I: Pb^{2+}

   Group II: Cu^{2+}, Pb^{2+}

   Group III: Al^{3+}, Fe^{3+}

   Group IV: Zn^{2+}, Mn^{2+}, Ni^{2+}, Co^{2+}

   Group V: Ba^{2+}, Sr^{2+}, Ca^{2+}

   Group VI: Mg^{2+}

NOTE:

- **For wet test of anions, sodium carbonate extract must be used (except for carbonate).**
- **Chromyl chloride test not to be performed.**

(Insoluble salts, such as lead sulphate, barium sulphate, calcium sulphate, strontium sulphate should not be given).

4. Preparation of inorganic compounds.

   (a) Preparation of potash alum/Mohr's salt.

   (b) Preparation of crystalline $FeSO_4$/$CuSO_4$.

5. Paper Chromatography.

   Preparation of chromatogram, separation of pigments from extracts of leaves and flowers/ink mixtures; determination of R_f value.

PROJECT WORK AND PRACTICAL FILE - 15 Marks

Project Work – 10 Marks

The candidate is to creatively execute one project/assignment on a selected topic of Chemistry. Teachers may assign or students may choose **any one** project of their choice. (Refer to the suggested topics at the end of Class XII syllabus).

Suggested Evaluation criteria for Project Work:

▪ Introduction / purpose
▪ Contents
▪ Analysis/ material aid (graph, data, structure, pie charts, histograms, diagrams, etc)
▪ Presentation
▪ Bibliography

Practical File – 5 Marks

Teachers are required to assess students on the basis of the Chemistry Practical file maintained by them during the academic year.

CHEMISTRY (862)

CLASS XII

There will be two papers in the subject:

Paper I: *Theory - 3 hours ... 70 marks*

Paper II: *Practical: 3 hours ... 15 marks*
Project Work ... 10 marks
Practical File ... 5 marks

PAPER I (THEORY) - 70 Marks

S.No.	UNIT	TOTAL WEIGHTAGE
1.	Solid State	**Physical Chemistry 25 Marks**
2.	Solutions	
3.	Electrochemistry	
4.	Chemical Kinetics	
5.	Surface Chemistry	
6.	General Principles and Processes of Isolation of Elements	**Inorganic Chemistry 20 Marks**
7.	p -Block Elements	
8.	d -and f -Block Elements	
9.	Coordination Compounds	
10.	Haloalkanes and Haloarenes	**Organic Chemistry 25 Marks**
11.	Alcohols, Phenols and Ethers	
12.	Aldehydes, Ketones and Carboxylic Acids	
13.	Organic Compounds containing Nitrogen	
14.	Biomolecules	
15.	Polymers	
16.	Chemistry in Everyday Life	
TOTAL		**70 Marks**

PAPER I –THEORY – 70 Marks

1. Solid State

Solids: their classification based on different binding forces such as: ionic, covalent molecular; amorphous and crystalline solids (difference), metals. Type of unit cell in two dimensional and three dimensional lattices, number of atoms per unit cell (all types). Calculation of density of unit cell, packing in solids, packing efficiency, voids, point defects, electrical and magnetic properties.

Band theory of metals. Conductors, semiconductors (*n* and *p* type) and insulators.

(i) Crystalline and amorphous solids.

(ii) Definition of crystal lattice, unit cell; types of unit cell (scc, fcc, bcc); calculation of the number of atoms per unit cell; relationship between radius, edge length and nearest neighbour distance. Calculation of density of unit cell, formula of the compound – numericals based on it; packing in 3 – D, packing fraction in scc, fcc, bcc with derivation; voids – types, location, formation (derivation of radius of voids).

(iii) Characteristics of crystalline solids; ionic (NaCl), metallic (Cu), atomic (diamond and graphite).

(iv) Point defects: Stoichiometric, non-stoichiometric and impurity defects (F- centres).

(v) Electrical properties: Conductors, semiconductors (n & p types) and insulators (Band Theory), piezoelectricity and pyroelectricity.

(vi) Magnetic properties: diamagnetic, paramagnetic, ferromagnetic, ferrimagnetic and antiferromagnetic.

2. Solutions

Study of concentration of solutions of solids in liquids, liquid in liquid, solubility of gases in liquids, solid solutions, Colligative properties - Raoult's law of relative lowering of vapour pressure (1st & 2nd), elevation of boiling point, depression of freezing point, osmotic pressure. Use of colligative properties in determining molecular masses of solutes, abnormal molecular mass association and dissociation, van't Hoff factor.

Normality, molality, molarity, mole fraction, ppm, as measures of concentration. Definition of the above with examples. Simple problems based on the above.

(i) Solubility of gases in liquids – Henry's Law, simple numericals based on the above.

(ii) Raoult's Law for volatile solutes and non-volatile solutes, ideal solution, non-ideal solution. Azeotropic mixtures – definition, types, graphical representation, fractional distillation with examples.

(iii) Colligative properties – definition and examples, and its use in determination of molecular mass.

(a) Relative lowering of vapour pressure: Definition and mathematical expression of Raoult's Law. Determination of relative molecular mass by measurement of lowering of vapour pressure.

(b) Depression in freezing point: molal depression constant (cryoscopic constant) – definition and mathematical expression (derivation included).

(c) Elevation in boiling point method: molal elevation constant (ebullioscopic constant) definition and mathematical expression (derivation included).

(d) Osmotic pressure: definition and explanation. Natural and chemical semipermeable membranes, reverse osmosis, isotonic, hypotonic and hypertonic solutions. Comparison between diffusion and osmosis. Application of osmotic pressure in the determination of relative molecular mass.

van't Hoff- Boyle's Law, van't Hoff – Charles' Law, van't Hoff - Avogadro's law.

(e) Abnormal molecular mass: Dissociation and Association with suitable examples

(f) van't Hoff factor for the electrolytes which dissociate and the molecules which associate in solution. Modification of the formula of colligative properties based on van't Hoff factor. Simple problems. Calculation of degree of dissociation and association. Experimental details not required.

Numerical problems based on all the above methods. Experimental details not required.

3. Electrochemistry

Electrolytic and electrochemical cells. Redox reactions in electrochemical cells. Electromotive Force (emf) of a cell, standard electrode potential, Nernst equation and its application to chemical cells. Relation between Gibbs energy change and emf of a cell.

Conductance in electrolytic solutions, specific, equivalent and molar conductivity, variations of conductivity with concentration, graphs; Kohlrausch's Law of electrolysis and Faraday's Laws of electrolysis. Dry cell and lead accumulator, fuel cells, corrosion.

(i) Electrochemical cells: introduction, redox reactions (principle of oxidation and reduction in a cell).

(ii) Galvanic cells - introduction; representation, principle – oxidation reduction. Mechanism of production of electric current in a galvanic cell.

(iii) Measurement of potential. Single electrode potentials.

Standard hydrogen electrode (E^o) - definition, preparation, application and limitations.

Standard electrode potential - Measurement of standard electrode potential of Zn^{++}/Zn, Cu^{++}/Cu, half cell (using standard hydrogen electrode).

Cell notation – representation.

Factors affecting electrode potential with explanation - main emphasis on the temperature, concentration and nature of the electrode.

(iv) Electrochemical series. Its explanation on the basis of standard reduction potential.

Prediction of the feasibility of a reaction.

(v) Nernst equation and correlation with the free energy of the reaction with suitable examples.

Prediction of spontaneity of a reaction based on the cell emf.

Numericals on standard electrode potential of half-cells, cell emf, relationship between free energy and equilibrium constant, standard electrode potential and free energy.

(vi) Comparison of metallic conductance and electrolytic conductance. Relationship between conductance and resistance. Specific resistance and specific conductance.

Cell constant: Calculation of cell constant. Meaning of equivalent conductance. Meaning of molar conductance. General relationship between specific conductance, molar conductance and equivalent conductance (units and graphs).

Units, numericals.

Molar conductance of a weak electrolyte at a given concentration and at infinite dilution. Kohlrausch's Law – definition, applications and numericals.

(vii) Faraday's laws of Electrolysis.

Faraday's First Law of electrolysis. Statement, mathematical form. Simple problems.

Faraday's Second Law of electrolysis: Statement, mathematical form. Simple problems.

Relation between Faraday, Avogadro's number and charge on an electron. $F = N_A e$ should be given (no details of Millikan's experiment are required).

(viii) Batteries: Primary and Secondary Cells: Leclanche cell, mercury cell, Lead storage battery and fuel cell – structure, reactions and uses.

(ix) Corrosion: Concept, mechanism of electrochemical reaction, factors affecting it and its prevention.

4. Chemical Kinetics

Meaning of Chemical Kinetics – slow and fast reactions. Rate of a reaction - average and instantaneous rate (graphical representation). Factors affecting rate of reaction: surface area, nature of reactants, concentration, temperature, catalyst and radiation. Order and molecularity of a reaction, rate law and specific rate constant. Integrated rate equations and half-life (only for zero and first order reactions), concept of collision theory (elementary idea, no mathematical treatment). Concept of threshold and activation energy, Arrhenious equation.

(i) Meaning of chemical kinetics, Scope and importance of Kinetics of the reaction, slow and fast reactions – explanation in terms of bonds.

(ii) Rate of Reaction: definition, representation of rate of reaction in terms of reactants and products, determination of rate of reactions graphically, instantaneous and average rate of reaction. Factors affecting rate of reaction.

(iii) Law of mass Action: statement and meaning of active mass. Explanation with an example – general reactions.

(iv) Effect of concentration of reactants on the rate of a reaction: Qualitative treatment, based on the law of mass Action, statement of rate law, General rate equation – Rate = k(concentration of the reactant)^n, where k is rate constant and n is the order of the reaction, relationship between the rate of the reaction with rate constant with respect to various reactants.

(v) Order of a reaction: meaning, relation between order and stoichiometric coefficients in balanced equations, order as an experimental quantity, rate equation for zero order reaction and its unit, mathematical derivation of rate equation for first order reaction, characteristics of first order reaction – rate constant is independent of the initial concentration, units to be derived, definition of half-life period, derivation of expression of half-life period from first order rate equation.

Problems based on first order rate equation and half-life period.

(vi) Molecularity of the reaction: Meaning – physical picture, Relation between order, molecularity and the rate of a reaction, Differences between order and molecularity of a reaction.

(vii) The concept of energy: Exothermic and endothermic reactions, concept of energy barrier, threshold and activation energy, formation of activated complex, effect of catalyst on activation energy and reaction rate.

(viii) Collision Theory: Condition for a chemical change – close contact, particles should collide. Collisions to be effective – optimum energy and proper orientation during collision. Energy barrier built-up when the collision is about to take place, Activated complex formation, difference in energy of the reactant and the product – exothermic and endothermic reactions with proper graphs and labelling.

(ix) Mechanism of the reaction: meaning of elementary reaction, meaning of complex and overall reaction, explanation of the mechanism of the reaction, slowest step of the reaction. Relationship between the rate expression, order of reactants and products at the rate-determining step, units of rate constant – explanation with suitable examples.

(x) Effect of temperature on the rate constant of a reaction: Arrhenius equation – $K=Ae^{-Ea/RT}$, Meaning of the symbols of Arrhenius equation, related graph, evaluation of E_a and A from the graph, meaning of slope of the graph, conversion from exponential to log form of the equation, relationship between the increase in temperature and the number of collisions. Numerical based on Arrhenius equation.

5. Surface Chemistry

Absorption and Adsorption - physisorption and chemisorption, factors affecting adsorption of gases on solids and liquids. Catalysis; homogenous and heterogenous, activity and selectivity, enzyme catalysis.

Colloidal state distinction between true solutions, colloids and suspension; lyophilic, lyophobic multi-molecular, macromolecular and associated colloids; properties of colloids; Brownian movement, Tyndall effect, coagulation and electrophoresis. Emulsion - types of emulsions.

(i) Difference between absorption and adsorption: definition of physisorption and chemisorption and their differences.

Factors affecting adsorption of gases on solids, Freundlich adsorption isotherms, graph, expression and application of adsorption.

(ii) *Catalysis: definition, types of catalysts – positive and negative, homogeneous and heterogeneous catalyst based on the state of the reactant and the catalyst, Elementary treatment of intermediate compound formation theory with examples; adsorption Theory, effect of catalyst on the rate of reaction – the change in the energy of activation in the activation energy curve. Characteristics of a catalyst; specificity, activity, surface area of a catalyst. Promoter and poison. Enzyme catalysis – basic idea and lock and key mechanism.*

(iii) *Colloidal State: Thomas Graham classified the substances as crystalloid and colloid, classification of substances on the basis of the particle size i.e. true solution, sol and suspension, colloidal system is heterogeneous. lyophilic and lyophobic colloid; classification of colloidal solutions as micro, macro and associated colloids.*

Preparation of lyophilic colloids. Preparation of lyophobic colloids by colloid mill, peptization, Bredig's arc method, oxidation, reduction, double decomposition and exchange of solvent method, purification of colloids (dialysis, ultra-filtration, and ultracentrifugation).

Properties of colloidal solutions: Brownian movement, Tyndall effect, coagulation, electrophoresis (movement of dispersed phase), Protection of colloids, Gold number and Hardy- Schulze rule. Emulsions, surfactants, micelles (only definition and examples).

Application of colloids and emulsions in daily life.

6. General Principles and Processes of Isolation of Elements

Metals: metallurgy, ores, principles and methods of extraction - concentration, oxidation, reduction, electrolytic refining. Occurrence and principles of extraction of aluminium, copper, zinc, iron and silver.

(i) *Definition of minerals, ores and metallurgy; principle ores of aluminium, iron, copper, zinc and silver.*

Methods of concentration of ores: hydraulic washing, magnetic separation, froth floatation method, leaching.

Extraction of metal from concentrated ore – calcination, roasting and thermal reduction.

Thermodynamic principle of metallurgy - Gibb's energy (Ellingham diagram – significance only).

Metallurgy of aluminium, iron, copper, zinc and silver.

Refining of metals - distillation, liquation, electrolysis, vapour phase refining (nickel), zone refining.

(ii) *Uses of metals and their alloys.*

7. p-Block Elements

Group-15 Elements

Position in the periodic table, occurrence, electronic configuration, oxidation states, trends in physical and chemical properties. Nitrogen: preparation properties and its uses; compounds of nitrogen: oxides of nitrogen. Ammonia and nitric acid – preparation and properties. Phosphorus - allotropic forms, compounds of phosphorus: preparation and properties of phosphine, halides and oxoacids.

(i) *General introduction, electronic configuration, occurrence, oxidation states. Trends in physical properties; chemical properties with hydrogen, oxygen and halogens.*

(ii) *Nitrogen - Laboratory preparation, decomposition (ammonium dichromate, barium azide). Properties and uses.*

(iii) *Oxides of nitrogen (N_2O, NO, N_2O_3, N_2O_4, N_2O_5) - preparation, structure and uses.*

(iv) *Ammonia – Preparation and manufacture. Properties: reaction with oxygen, copper oxide, chlorine, hydrochloric acid, formation of complexes. Uses.*

(v) *Nitric Acid - Preparation and manufacture. Properties: reaction with copper (dilute and concentrated HNO_3), carbon and sulphur. Uses.*

(vi) Allotropes of phosphorus and their structures.

Phosphine – preparation from phosphorus and properties: reaction with halo acids).

Phosphorus trichloride - Preparation from phosphorous. Uses.

Phosphorus pentachloride - preparation from PCl_3. Thermal dissociation and hydrolysis. Uses, properties.

Oxoacids of phosphorus (structures and preparation only).

Group-16 Elements

Position in the periodic table, occurrence, electronic configuration, oxidation states, trends in physical and chemical properties. Oxygen: methods of preparation, properties and uses, classification of oxides. Ozone – methods of preparation. Sulphur -allotropic forms. Compounds of sulphur: preparation, properties and uses of sulphur-dioxide, sulphuric acid (industrial process of manufacture). Oxoacids of sulphur (structures only).

(i) Electronic configuration, oxidation states, occurrence. Trends in physical properties; chemical properties with hydrogen, oxygen and halogens.

(ii) Oxygen – lab method of preparation, formation of oxides with metals and non-metals and their common nature.

(iii) Ozone: manufacture by Siemen's ozoniser, thermal decomposition of ozone, its oxidising nature – reaction with lead sulphide, potassium iodide and mercury, its uses.

(iv) Sulphur: allotropes of sulphur - rhombic, monoclinic, structure of sulphur and action of heat; extraction by Frasch process.

(v) Sulphur dioxide: laboratory and industrial preparation from sulphites and sulphide ores, reaction of sulphur dioxide with NaOH, Cl_2, $KMnO_4$ and structure of SO_2.

(vi) Oxoacids of sulphur: structures only.

Sulphuric Acid: manufacture by Contact Process (equations, conditions and diagram), properties - acidic nature, mode of dilution, oxidising action, dehydrating nature and uses of sulphuric acid in industry.

Group-17 Elements

Position in the periodic table, occurrence, electronic configuration, oxidation states, trends in physical and chemical properties; Preparation, properties and uses of chlorine and hydrochloric acid. Compound of halogen, oxoacids of halogens (structures only), Interhalogen compounds.

(i) General introduction, electronic configuration, oxidation states. Trends in physical properties and chemical properties (hydrogen, oxygen, halogens and metals).

(ii) Chlorine – preparation from MnO_2 and HCl, from NaCl, MnO_2 and conc. H_2SO_4 (only equations), reactions of chlorine with H_2S, NH_3, cold, dilute NaOH and hot, concentrated NaOH.

(iii) Hydrochloric acid: Lab preparation, its acidic nature, reaction with ammonia, carbonates and sulphites, formation of aqua regia and its uses.

(iv) Oxoacids of halogens: structures and acidic property.

(v) Interhalogen compounds – structure, hybridisation and shapes: XX', XX'_3, XX'_5, XX'_7.

Group-18 Elements

Position in the periodic table, occurrence, electronic configuration, trends in physical and chemical properties, inert nature, uses.

(i) General introduction, electronic configuration, occurrence, trends in physical; chemical properties, state and low reactivity.

(ii) Formation of xenon compounds with fluorine and oxygen (equations only), hybridisation, shape and structure of compounds.

(iii) Uses of noble gases.

8. d and f Block Elements

Position in the periodic table, occurrence, electronic configuration and characteristics of transition metals, general trends in properties of the 3d-series of transition metals - metallic character, ionisation enthalpy, oxidation states, ionic radii, colour of ions, catalytic property, magnetic properties, interstitial compounds, alloy formation, preparation and properties of $K_2Cr_2O_7$ and $KMnO_4$.

Lanthanoids and actinoids.

(i) d-Block: 3d, 4d and 5d series

Study in terms of metallic character, atomic and ionic radii, ionisation enthalpy, oxidisation states, variable valency, formation of coloured compounds, formation of complexes, alloy formation.

(ii) f-Block: 4f and 5f series

Electronic configuration, atomic and ionic radii, oxidisation states, formation of coloured compounds, formation of complexes, alloy formation. Lanthanoid contraction and its consequences. Chemical reactivity – with oxygen, hydrogen, halogen, sulphur, nitrogen, carbon and water.

Actinoids - oxidation states and comparison with lanthanoids.

(iii) Potassium permanganate: structure, shape, equation of extraction from pyrolusite ore, its oxidising nature in acidic, basic and neutral medium, use in redox titration.

Oxidising nature in acidic [$FeSO_4$, $(COOH)_2.2H_2O$, KI], basic (KI) and neutral (H_2S) mediums to be done.

(iv) Potassium dichromate: structure, shape, equation of extraction from chromite ore and its use in titration. Oxidising nature in acidic, basic and neutral medium, use in redox titration. Interconversion of chromate and dichromate ion (effect of pH).

9. Coordination Compounds

Concept of complexes, definition of ligands, coordination number, oxidation number. IUPAC nomenclature of mononuclear coordination compounds. Isomerism (structural and stereo). Bonding, Werner's theory, VBT and CFT. Colour, magnetic properties and shapes. Importance of coordination compounds (in qualitative analysis, extraction of metals and biological system).

(i) Definition of coordination compounds / complex compounds, differences with a double salt, study of ligands – mono-, bi-, tri-, tetra-, penta-, hexa- and polydentate, chelating ligands, definition of coordination number, its calculation for a complex coordination sphere, study of oxidation state of an element in a complex, its calculation, IUPAC rules of nomenclature of coordination compounds.

(ii) Isomerism – structural, stereo types and examples.

(iii) Valence bond theory of coordination compounds – examples of formation of inner orbital and outer orbital complexes (high and low spin, octahedral, tetrahedral and square planar), prediction of magnetic character.

(iv) Crystal field theory – crystal field splitting in tetra and octahedral systems. Explanation of colour and magnetic character.

(v) Stability of coordination compounds (explain stability on the basis of magnitude of K) as mentioned above).

(vi) Importance and uses.

10. Haloalkanes and Haloarenes.

Haloalkanes: General formula, nomenclature and classification. Nature of C–X bond, physical and chemical properties, mechanism of substitution reactions, optical rotation.

Haloarenes: Basic idea, nature of C–X bond, substitution reactions (directive influence of halogen in monosubstituted compounds only).

Uses and environmental effects of - dichloromethane, trichloromethane, tetra-chloromethane, iodoform, freons and DDT.

Nature of C-X bond

Naming the halogen derivatives of alkanes by using common system and IUPAC system for mono, di and tri-halo derivatives.

Preparation of haloalkanes from:

- *Alkane and halogen.*
- *Alkene and hydrogen halide.*
- *Alcohols with PX_3, PCl_5 and $SOCl_2$.*
- *Halide exchange method (Finkelstein and Swarts)*
- *Silver salt of fatty acids (Hunsdiecker).*

Physical properties: State, melting point, boiling point and solubility.

Chemical properties: nucleophilic substitution reactions (S_N1, S_N2 mechanism in terms of primary, secondary and tertiary halides) Reaction with: sodium hydroxide, water, sodium iodide, ammonia, primary amine, secondary amine, potassium cyanide, silver cyanide, potassium nitrite, silver nitrite, silver salt of fatty acid and lithium-aluminium hydride.

Elimination reaction (Saytzeff's rule) / β elimination.

Reaction with metals: sodium and magnesium (Wurtz's reaction, Grignard's reagent preparation).

Chloroform and iodoform: preparation and properties.

Structure of freons.

Preparation of haloarenes by Sandmeyer's and Gattermann's reaction, by electrophilic substitution.

Physical properties: State, melting point, boiling point and solubility.

Chemical properties:

- *Electrophilic substitution (chlorination nitration and sulphonation) with mechanism.*
- *Nucleophilic substitution (replacement of chlorine with -OH, -NH_2) with mechanism.*
- *Reduction to benzene.*
- *Wurtz-Fittig reaction.*
- *Fittig reaction.*
- *Addition reaction with magnesium (formation of Grignard reagent).*
- *Structure of DDT.*

11. Alcohols, Phenols and Ethers

Alcohols: Classification, general formula, structure and nomenclature. Methods of preparation, physical and chemical properties (of primary alcohols only), identification of primary, secondary and tertiary alcohols, mechanism of dehydration, uses with special reference to methanol and ethanol.

(i) Classification into monohydric, dihydric and polyhydric alcohols, general formulae, structure and nomenclature of alcohols. Difference between primary, secondary and tertiary alcohols in terms of structure, physical properties and chemical properties.

(ii) Methods of preparation:

- *Hydration of Alkenes – direct hydration, indirect hydration, hydroboration oxidation.*
- *From Grignard's reagent.*
- *Hydrolysis of alkyl halides.*
- *Reduction of carbonyl compounds.*
- *From primary amines.*

Manufacture of methanol by Bosch process and ethanol by fermentation of carbohydrates, chemical equations required (only outline of the method of manufacture, detail not required).

Properties:

- *Acidic nature of alcohols:*
- *Reaction with sodium.*
- *Esterification with mechanism.*
- *Reaction with hydrogen halides.*
- *Reaction with PCl_3, PCl_5, and $SOCl_2$.*
- *Reaction with acid chlorides and acid anhydrides*
- *Oxidation.*
- *Dehydration with mechanism.*

Uses of alcohols.

(iii) Conversion of one alcohol into another.

(iv) Distinction between primary, secondary and tertiary alcohols by Lucas' Test.

Phenols: Classification and nomenclature. Methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses ofphenols.

Preparation of phenol from diazonium salt, chlorobenzene (Dow's process) and from benzene sulphonic acid.

Manufacture from Cumene.

Physical properties: state and solubility.

Chemical properties:

- *Acidic character of phenol.*
- *Reaction with sodium hydroxide.*
- *Reaction with sodium.*
- *Reaction with zinc.*
- *Reaction with acetyl chloride and acetic anhydride.*
- *Reaction with phosphorus penta chloride.*
- *Bromination, nitration and sulphonation (Electrophilic substitution reactions).*
- *Kolbe's reaction (formation of salicylic acid).*
- *Reimer – Tiemann reaction*
- *Test for phenol – $FeCl_3$ test, azo dye test.*

Aliphatic Ethers: General formula, structure and nomenclature. Methods of preparation, physical and chemical properties, uses.

Ethers: structure of ethereal group.

Preparation from alcohol (Williamson's synthesis).

Physical properties: state, miscibility.

Chemical properties:

- *Reaction with chlorine.*
- *Oxidation (peroxide formation).*
- *Reaction with HI.*
- *Reaction with PCl_5.*

Aryl ethers

Physical properties – state and solubility.

Chemical properties – preparation of anisole (Williamson's synthesis), electrophilic substitution (halogenation, nitration and Friedel-Crafts reaction.)

Uses of ether.

12. Aldehydes, Ketones and Carboxylic Acids

Aldehydes and Ketones: Nomenclature, structure of methods of preparation of aldehydes and ketones, physical and chemical properties, mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes and uses.

Preparation:

- *From alcohol.*
- *From alkenes (ozonolysis).*
- *From alkynes (hydration).*
- *From acid chlorides (Rosenmund's reduction, reaction with dialkyl cadmium).*
- *From calcium salt of carboxylic acids.*
- *From nitriles (Stephen reaction, Grignard's reagent).*
- *From esters.*

Physical properties – state and boiling point.

Chemical properties:

- *Nucleophilic addition reactions with mechanism (ammonia and its derivatives, HCN, $NaHSO_3$ and Grignard's reagent).*
- *Oxidation reactions, iodoform reaction.*
- *Reduction: reduction to alcohol and alkanes (Clemmensen's reduction, Wolff-Kishner reduction, Red phosphorus and HI).*
- *Base catalysed reactions (with mechanism): Aldol condensation, cross Aldol condensation, Cannizzaro's reaction.*

Tests: difference between formaldehyde and acetaldehyde; aldehydes and ketones.

Uses of aldehydes and ketones.

Aromatic aldehyde (Benzaldehyde)

Lab preparation from toluene by oxidation with chromyl chloride.

Physical properties: state and stability.

Chemical properties:

- *Oxidation and reduction.*
- *Nucleophilic addition reaction (hydrogen cyanide and sodium bisulphite).*
- *Reactions with ammonia and its derivatives (hydroxyl amine, hydrazine and phenyl hydrazine).*
- *Reaction with phosphorus pentachloride.*
- *Cannizzaro reaction.*
- *Benzoin condensation.*
- *Perkin's reaction.*
- *Electrophilic substitution - halogenation, nitration and sulphonation.*

Test: distinction between aromatic and aliphatic aldehydes.

Uses of benzaldehyde.

Carboxylic Acids: Classification, general formula and structure of carboxylic group. Nomenclature, acidic nature, methods of preparation, physical and chemical properties and uses.

Classification of mono and di carboxylic acids with examples.

Preparation of aliphatic and aromatic carboxylic acid:

- *From alcohols, aldehydes.*
- *From nitriles.*
- *From Grignard's reagent.*

Physical properties: state, boiling point and solubility.

Chemical properties:

- *Acidic character: (aliphatic, aromatic carboxylic acids with the effect of substituents on the acidic character – to be dealt with in detail)*
- *Reaction with active metals, alkalies, carbonates and bicarbonates,*
- *Formation of acid derivatives.*
- *Decarboxylation (chemical and Kolbe's electrolytic reaction).*
- *HVZ reactions.*
- *Substitution of benzene ring (meta directive effect of carboxylic acid group) nitration and sulphonation.*

Tests for acids: formic acid, acetic acid and benzoic acid.

Uses of formic acid, acetic acid and benzoic acid.

13. Organic compounds containing Nitrogen

Aliphatic Amines: General formula and, classification of amines. Structure of the amino group, nomenclature. Methods of preparation, physical and chemical properties, uses, identification of primary, secondary and tertiary amines.

- *Amines*

  Nomenclature, classification with examples, structure, general formula.

  Methods of preparation:

  - *From alcohol.*
  - *From alkyl halide.*
  - *From cyanide.*
  - *From amide (Hofmann's degradation).*
  - *From nitro compounds.*
  - *Gabriel phthalimide Synthesis.*

  Physical properties: comparison between primary, secondary and tertiary amines in terms of – state, solubility, boiling point (hydrogen bonding), comparison with alcohols.

  Chemical properties:

  - *Basic character of amines – comparison between primary, secondary and tertiary alkyl amines/ ammonia/ aniline. Effect of substituents on the basic strength of aniline*
  - *Alkylation and acylation with mechanism.*
  - *Reaction with nitrous acid.*
  - *Carbylamine reaction.*

    Distinction between primary, secondary and tertiary amines (Hinsberg's Test).

Aniline

Preparation reduction of nitrobenzene.

Physical properties – state, solubility and boiling point.

Chemical properties:

- *Reaction with HCl and H_2SO_4.*
- *Acetylation, alkylation.*
- *Benzoylation.*
- *Carbylamine reaction.*
- *Diazotisation.*
- *Electrophilic substitution (bromination, nitration and sulphonation).*

Tests for aniline.

Uses of aniline.

Cyanides and Isocyanides

Methods of preparation:

Cyanides:

- *From alkyl halide.*
- *From amide.*

Isocyanides:

- *From alkyl halide.*

From primary amines

Diazonium salts: Preparation, chemical reactions and importance in synthetic organic chemistry.

Preparation from aniline;

Properties: Sandmeyer's reaction, Gattermann reaction and Balz – Scheimann reaction, replacement of diazo group by – H, -OH, -NO_2, coupling reaction with phenol and aniline.

12. Biomolecules

Carbohydrates – Definition, Classification (aldoses and ketoses), monosaccahrides (glucose and fructose), D-L configuration oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen); Importance of carbohydrates.

Carbohydrates: definition, classification - mono (aldose, ketose), oligo (di, tri, tetra saccharides) and polysaccharides with examples: reducing sugars and non-reducing sugars – examples and uses.

Establishment of structures for glucose and fructose (open and cyclic) heating with HI, reaction with hydroxylamine, bromine water, acetic anhydride, nitric acid and phenyl hydrazine.

Test for glucose and fructose (bromine water test with equation).

Disaccharides – structures of sucrose, maltose and lactose (glycosidic linkage).

Polysaccharides – starch, cellulose, glycogen.

Proteins – structural units of proteins. Basic idea of - amino acids, peptide bond, polypeptides, proteins, structure of proteins - primary, secondary, tertiary structure and quaternary structures (qualitative idea only), denaturation of proteins. Enzymes, hormones - elementary idea only.

Proteins: Amino acids – general structure, classification and zwitter ion formation. Isoelectric point.

Classification of proteins on the basis of molecular shape; primary, secondary, tertiary and quaternary, structures of proteins, denaturation of proteins. (Definitions only. Details and diagrams are not required).

Vitamins - Classification and functions.

Vitamins A, B, C, D, E and K: classification (fat soluble and water soluble), deficiency diseases. (Chemical names and structures are not required).

Nucleic Acids - DNA and RNA.

Nucleic acids: basic unit – purine and pyrimidine, DNA – structure (double helical), RNA (No chemical structure required). Differences between DNA and RNA.

13. Polymers

Definition and classification on different parameters. Methods of polymerisation (addition and condensation), copolymerisation, and some important polymers: natural and synthetic like polythene, nylon polyesters, bakelite, rubber. Biodegradable and non-biodegradable polymers.

Classification based on source, on structure, on mode of polymerisation, on molecular forces, on growth (with free radical mechanism).

Preparation of important addition polymers - Polythene, polypropene, PVC, PTFE, polystyrene.

Rubber – natural and synthetic (Buna-N and Buna-S), vulcanisation of rubber.

Preparation of important condensation polymers - polyester, Nylon 66, Nylon 6, Bakelite, melamine (to be learnt in terms of monomers and equations).

Biodegradable polymers – PHBV, Nylon 2 - Nylon 6.

Uses.

14. Chemistry in Everyday life

Chemicals in medicines - analgesics, tranquilizers antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.

In medicine: antipyretics, analgesics, tranquillisers, antiseptics, disinfectants, anti-microbials, anti-fertility drugs, antihistamines, antibiotics, antacids.

Definition, common examples, uses.

Differences between antiseptics and disinfectants.

Structure not required.

Chemicals in food - preservatives, artificial sweetening agents, elementary idea of antioxidants.

Preservatives: role, example (Sodium benzoate).

Artificial sweetening agents: role, examples (aspartame, saccharine, sucralose and alitame).

Soaps and detergents - Classification and their cleansing action.

Soaps and detergents: classification, structure and some important examples.

Advantage of detergents over soaps; classification of detergents into anionic/biodegradable, cationic/non-biodegradable and non-ionic.

PAPER II

PRACTICAL WORK – 15 Marks

Candidates are required to complete the following experiments:

1. Titrations

Oxidation-reduction titrations: potassium manganate (VII) / ammonium iron (II) sulphate; potassium manganate (VII) / oxalic acid.

The candidate may be required to determine the percentage purity of a compound and the number of molecules of water of crystallization in hydrated salts. In such experiments sufficient working details including recognition of the end point will be given.

Candidates will be required to calculate:

- *Molarity*
- *Concentration in grams L^{-1} / molecular mass*
- *Number of molecules of water of crystallisation/ percentage purity.*

NOTE: Molarity must be calculated upto 4 decimal places at least, in order to avoid error.

OBSERVATION TABLE

S. No.	**(A)**	**(B)**	**(B – A)**
	Initial burette reading (ml)	**Final burette reading (ml)**	**Difference (ml)**
1			
2			
3			

- Concordant reading is to be used for titre value. Concordant reading is two consecutive values which are exactly the same. Average will not be accepted as titre value.
- The table is to be completed in ink only. Pencil is not to be used.
- Overwriting will not be accepted in the tabular column.

Observations:

- Pipette size (should be same for all the candidates at the centre).
- Titre value (concordant value).

2. Study of the rate of reaction

The candidates will be required, having been given full instructions, to carry out an experiment on the rate of reaction, e.g. reaction between sodium thiosulphate and hydrochloric acid (using different concentrations for either), magnesium and dil. sulphuric acid/ dil. hydrochloric acid (using different concentrations).

- *Graph of volume vs. time and its interpretation.*
- *Relationship between concentration and rate, volume and rate and time and rate.*

3. Identification of the following compounds and functional groups based on observations

- Alcoholic group - glycerol
- Aldehyde group- formaldehyde
- Ketonic group – acetone
- Carboxylic group – benzoic acid
- Amino group - aniline

***Please Note: Carbylamine and acrolein tests should not be performed.**

The student should learn to differentiate between colours, solution, ring and precipitate.

4. Characteristic tests of carbohydrates and proteins

- Carbohydrates – glucose
- Proteins – powdered milk

Identification should be of 'Carbohydrate' and 'Protein' not of individual substances.

5. Experiments related to pH change using pH paper or universal indicator.

- Determination of pH of some solutions obtained from fruit juice, solutions of known and varied concentrations of acids, bases and salts.
- Comparison of pH of the solutions of strong and weak acids of the same concentration.

Use of universal indicator/pH paper must be taught to the students.

6. Electrochemistry

Setting up a simple voltaic cell.

Variation of cell potential in $Zn/Zn^{2+}//Cu^{2+}/Cu$ with change in concentration of electrolyte ($CuSO_4$, $ZnSO_4$) at room temperature.

7. Qualitative analysis

Qualitative analysis: identification of single salt containing one anion and one cation:

Anions: CO_3^{2-}, NO_2^-, S^{2-}, SO_3^{2-}, SO_4^{2-}, NO_3^-, CH_3COO^-, Cl^-, Br^-, I^-, $C_2O_4^{2-}$, PO_4^{3-}.

Cations: NH_4^+, Pb^{2+}, Cu^{2+}, Al^{3+}, Fe^{3+}, Zn^{2+}, Mn^{2+}, Ni^{2+}, Co^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}.

NOTE:

Chromyl chloride test not to be performed.

For wet test of anions, sodium carbonate extract must be used (except for carbonate).

(Insoluble salts such as lead sulphate, barium sulphate, calcium sulphate, strontium sulphate will not be given).

Anions: Dilute acid group – CO_3^{2-}, NO_2^-, S^{2-}, SO_3^{2-}

Concentrated Acid Group – NO_3^-, Cl^-, Br^-, I^-, CH_3COO^-.

Special Group - SO_4^{2-}, PO_4^{3-}, *$C_2O_4^{2-}$.*

Cations: Group Zero: NH_4^+

Group I: Pb^{2+}

Group II: Cu^{2+}, Pb^{2+}

Group III: Al^{3+}, Fe^{3+}

Group IV: Zn^{2+}, Mn^{2+}, Ni^{2+}, Co^{2+}

Group V: Ba^{2+}, Sr^{2+}, Ca^{2+}

Group VI: Mg^{2+}

NOTE:

- *Formal analytical procedure is required for Qualitative Analysis.*
- *Specific solvent for O.S. to be used;*
- *Before adding Group III reagents to the filtrate of Group II, H_2S must be removed followed by boiling with conc. Nitric acid.*
- *The right order for buffer (NH_4Cl and NH_4OH) must be used.*
- *The flame test with the precipitate obtained in Group V for Ba^{2+}, Sr^{2+}, Ca^{2+} will also be accepted as a confirmatory test.*

For wet test of anions, sodium carbonate extract must be used (except for carbonate).

PATTERN OF CHEMISTRY PRACTICAL PAPER

Questions in the practical paper will be set as follows:

Question 1	**Volumetric Analysis**
Question 2	**Any one or a combination of the following experiments:**
	• Study of the rate of reaction.
	• Identification of the organic compounds and functional groups based on observations.
	• Characteristic tests of carbohydrates and proteins.
	• Experiments related to pH determination using pH paper or universal indicator.
	• Electrochemistry.
Question 3	**Qualitative Analysis (single salt).**

PROJECT WORK AND PRACTICAL FILE - 15 Marks

Project Work – 10 Marks

The project work is to be assessed by a Visiting Examiner appointed locally and approved by CISCE.

The candidate is to creatively execute **one** project/assignment on an aspect of Chemistry. Teachers may assign or students may select a topic of their choice. Following is only a suggestive list of projects.

Suggested Evaluation criteria for Project Work:

• Introduction / purpose
• Contents
• Analysis/ material aid (graph, data, structure, pie charts, histograms, diagrams, etc.)
• Presentation
• Bibliography

Suggested Assignments:

1. Amino acids: Peptides, structure and classification, proteins structure and their role in the growth of living beings.
2. Nucleic Acid: DNA and RNA – their structure. Unique nature. Importance in evolution and their characteristic features.
3. Carbohydrates and their metabolism, Blood - haemoglobin and respiration.
4. Vitamins and hormones
5. Simple idea of chemical evolution.
6. Natural polymers (any **five**) - structure, characteristics, uses. Synthetic polymers (any **five) -** method of preparation, structure, characteristics and uses.
7. Types of Dyes - methods of preparation, characteristics and uses.
8. Chemicals in medicines: antiseptics, antibiotics, antacids, etc. and their uses.
9. Preparation of soap, nail polish, boot polish, varnish, nail polish remover, shampoo and perfumes.
10. Chemicals and chemical processes in forensic studies.
11. Insecticides, pesticides and chemical fertilisers.
12. Ancient Indian medicines and medicinal plants.
13. Organic Chemistry in Nutrition, Food Science and Biotechnology.
14. Effect of Green House Gases.
15. How Plastics have changed the world, both socially and economically.

Practical File – 5 Marks

The Visiting Examiner is required to assess students on the basis of the Chemistry Practical file maintained by them during the academic year.

NOTE: According to the recommendation of International Union of Pure and Applied Chemistry (IUPAC), the groups are numbered from 1 to 18 replacing the older notation of groups IA ….. VIIA, VIII, IB …… VIIB and 0. However, for the examination both notations will be accepted.

Old notation	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII			IB	IIB	IIIA	IVA	VA	VIA	VIIA	0
New notation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

BIOLOGY (863)

CLASS XI

There will be two papers in the subject:

Paper I: *Theory: 3 hours …70 marks*

Paper II: *Practical: 3 hours … 15 marks*
Project Work … 10 marks
Practical File … 5 marks

PAPER 1- THEORY: 70 Marks

S.NO.	UNIT	TOTAL WEIGHTAGE
1.	Diversity of Living Organisms	09 Marks
2.	Structural Organisation in Animals and Plants	11 Marks
3.	Cell: Structure and Function	15 Marks
4.	Plant Physiology	17 Marks
5.	Human Physiology	18 Marks
TOTAL		**70 Marks**

PAPER I –THEORY – 70 Marks

Note: All structures (internal and external) are required to be taught along with diagrams.

1. Diversity of Living Organisms

(i) The Living World

Need for classification; three domains of life; taxonomy and systematics; concept of species and taxonomical hierarchy; binomial nomenclature.

Need for classification should be discussed. Three domains of life – distinguishing features of (archaea, bacteria, eukarya). Definition and explanation of the terms taxonomy (numerical taxonomy, cytotaxonomy and chemotaxonomy) and systematics. Concept of species. Major taxonomical hierarchies (phylum, class, order, family, genus, species): definition and examples with reference to classification of man, house fly, mango and wheat. Rules of binomial nomenclature and advantages of using scientific names.

Three systems of classification – artificial, natural and phylogenetic.

(ii) Biological Classification

Five kingdom classification; salient features and classification of Monera, Protista, Fungi, Plantae and Animalia. Lichens, Viruses and Viroids.

(a) Five-kingdom system of classification and characteristics of different kingdoms with examples.

(b) Kingdom Monera: Bacteria - classification of bacteria according to shape, nutrition and mode of respiration; differences between gram +ve and gram –ve bacteria; types of reproduction – definition of fission, conjugation, transduction and transformation (details not required).

A brief idea of the role of different types of archaebacteria (methanogens, halophiles and thermoacidophiles in their extreme environments).

Mycoplasma – three distinctive features.

Economic importance with reference to role of bacteria in sewage treatment, antibiotics, energy production and house hold products (curd and cheese only).

(c) Kingdom Protista – only two general characteristics and two examples of subgroups: (i) Chrysophytes (ii) Dinoflagellates, (iii) Euglenoids, (iv) Slime moulds, (v) Protozoans (to be studied under rhizopods, flagellates, ciliates and sporozoans with two characteristics including modes of locomotion and two examples of each).

(d) Kingdom Fungi: general characteristics and mode of reproduction of each (including types of spores and sexual reproduction – definition of isogamy, anisogamy, oogamy, plasmogamy, karyogamy and dikaryophase). Zygomycetes, Ascomycetes, Basidiomycetes, Deuteromycetes - characteristics with examples. Role of fungi in the field of medicine, bakery and environmental decomposition. Definition of lichens and mycorrhiza (ecto and endo).

Life cycles not required.

(e) Virus (characteristic features – link between living and non-living, structure of TMV and bacteriophage and contribution of the following scientists: D.J. Ivanowsky, M.W. Beijerinck, W.M. Stanley) and Viroid (definition only).

(iii) Plant Kingdom

(a) Algae - characteristics (morphology, common name, major pigments, stored food, composition of cell wall, flagellar number and position of insertion, habitat, mode of sexual reproduction) and examples of Chlorophyceae, Phaeophyceae, Rhodophyceae; Economic importance of algae – any five.

(b) Bryophyta – general characteristics, distinctive features of liverworts and mosses; graphic outline of life cycle of Funaria with reference to alternation of generations. Economic importance of bryophytes.

(c) *Pteridophyta: characteristics; classification into classes: psilopsida (Psilotum), lycopsida (Selaginella, Lycopodium), sphenopsida (Equisetum) and pteropsida (Dryopteris, Pteris and Adiantum). Graphic outline of life cycle of a typical pteridophyte (fern). Definition of homospory and heterospory with relevant examples. Economic importance.*

(d) *Gymnosperms: general characteristics and graphic outline of life cycle of a typical gymnosperm (Pinus). Economic importance.*

(iv) Animal Kingdom

Animal Kingdom: animal construction - body plan (cell aggregate plan, blind-sac plan and tube-within-tube plan), symmetry (spherical, radial and bilateral symmetry), coelom development (diploblastic and triploblastic organisation in animals, acoelomate, pseudocoelomate, coelomate and haemocoelomate), segmentation.

Non-chordata - five distinguishing characters with two examples of Porifera, Cnidaria, Ctenophora, Platyhelminthes, Nematoda (Aschelminthes), Annelida, Mollusca, Arthropoda, Echinodermata, Hemichordata.

Chordata – sub-classification of Chordata with reference to notochord - sub phyla Urochordata, Cephalochordata. Vertebrata (classes – cyclostomata, chondrichthyes, osteichthyes, amphibia, reptilia, aves and mammalia) – three distinguishing characters with two examples of each).

2. Structural Organisation in Animals and Plants

(i) Morphology of Flowering Plants

(a) Morphology and modifications of root, stem, leaf.

Types of roots (tap, fibrous, adventitious), regions, modifications of roots for storage (Tuberous – e.g. Mirabilis and sweet potato; fusiform – e.g. radish; conical – e.g., carrot; napiform – e.g. turnip), respiration (pneumatophores) and support (stilt and prop).

Stems – features (nodes internodes, buds), modifications – underground (tuber, rhizome, corm) aerial (tendril, thorn, Phylloclade, cladode) and sub-aerial (runner, sucker, stolon, offset).

Leaves - parts of a simple leaf, venation, types of leaves (simple and compound – pinnate and palmate), phyllotaxy – alternate, opposite, whorled (with an example of each). Modifications for mechanical support (tendril), protection (spine), storage (bulb), reproduction (Bryophyllum); insectivorous plants (pitcher plant, Venus-fly-trap).

(b) Morphology of flower. Structure of a typical flower, types of inflorescence (racemose and cymose).

Structure of a typical flower, bracteates/ebracteate, [symmetry (actinomorphic, zygomorphic), trimerous/tetramerous/pentamerous complete/ incomplete, non-essential whorls (calyx: gamosepalous, polysepalous, corolla: gamopetalous, polysepalous, perianth, aestivation: valvate, twisted, imbricate, vexillary), essential whorls (androecium: cohesion - syngenesious, synandrous, monadelphous, diadelphous, polyadelphous; adhesion – epipetalous, epiphyllous; number of lobes – monothecous, dithecous; Gynoecium: position of ovary – epigynous, hypogynous, perigynous, cohesion – apocarpous, syncarpous, number of locules – unilocular, bilocular, multilocular], types of inflorescence (racemose and cymose – definition and differences; subtypes not required).

(ii) Anatomy of Flowering Plants

Plant Tissues: types of plant tissues: Meristematic tissues: classification of meristematic tissue. Permanent Tissues: structure and function of simple tissues (parenchyma, collenchyma and sclerenchyma) and complex tissues (xylem and phloem), tissue system. Internal structure of root, stem, and leaf.

Characteristics of meristematic tissue; classification of meristems based on origin and location; structure, function and location of permanent tissues; simple and

complex tissues; epidermal, ground and vascular tissue systems.

Cellular diagrams of T.S. of roots and stem and V.S. of monocot and dicot leaves are required.

(iii) Structural Organisation in Animals: Frog

Morphology, anatomy and functions of different systems (digestive, circulatory, respiratory, nervous and reproductive) of frog a brief account only.

3. Cell: Structure and Function

(i) Cell - the Unit of Life

Cell theory and cell as the basic unit of life: Structure of prokaryotic and eukaryotic cells; Plant cell and animal cell; cell envelope; cell membrane, cell wall; cell organelles – ultrastructure and function; endomembrane system, mitochondria, ribosomes, plastids, microbodies; cytoskeleton, cilia, flagella, centrioles; nucleus.

Historical aspects, cell theory, size and shape of cells; *general structure of prokaryotic cell.*

General structure of eukaryotic cell, ultra-structure and function of cell wall (including definition of plasmodesmata), cell membrane [(description of fluid mosaic model; functions of the plasma membrane: active and passive transport, brief explanation of facilitated diffusion (uniport, symport and antiport) with one example]. Mitochondria, nucleus (nuclear membrane, chromatin, nucleolus, structure and types of chromosomes on the basis of the position of centromere, satellite), types of plastids, endomembrane system (endoplasmic reticulum, Golgi complex, lysosomes and vacuoles), ribosomes, microbodies, cytoskeleton (microfilaments, microtubules and intermediate filaments), cilia, flagella and centrioles; differences between prokaryotic cell and eukaryotic cell, plant cell and animal cell.

(ii) Biomolecules

Proteins, carbohydrates, lipids, enzymes.

Carbohydrates: general classification and functions of: monosaccharides (glucose, ribose and deoxyribose), disaccharides (maltose, lactose and sucrose), polysaccharides (glycogen, starch, cellulose, inulin, and chitin).

Proteins: amino acids – (structure: glycine, alanine, serine); amino acids as zwitter-ion; examples of acidic, basic, neutral, sulphur containing amino acids; essential and non-essential amino acids; levels of protein structure (primary, secondary, tertiary and quaternary); functions of proteins.

Lipids: classification, structure and functions of fats and oils.

Enzymes: general properties, nomenclature and classification of enzymes according to type of reactions, co-factors (prosthetic groups, coenzymes and metal ions). Factors affecting enzyme activity - temperature, pH, substrate concentration. Competitive inhibitors.

(iii) Cell Cycle and Cell Division

Cell cycle, mitosis, meiosis and their significance.

Definition of C-value, different stages of cell cycle (G_o, G_1, S and G_2 and M).

Different stages of mitosis and meiosis (prophase – I) with diagrams. Significance of mitosis and meiosis. Differences between mitosis and meiosis.

4. Plant Physiology

(i) Photosynthesis in higher plants

Photosynthesis as a mean of autotrophic nutrition; site of photosynthesis, pigments involved in photosynthesis (elementary idea); photochemical and biosynthetic phases of photosynthesis; cyclic and non-cyclic photophosphorylation; chemiosmotic hypothesis; photorespiration; C_3 and C_4 pathways; factors affecting photosynthesis.

Contributions of Priestley, Sachs, Engelmann, van Neil; differences between absorption and action spectra.

Brief idea of photosynthetic pigments (difference between chlorophyll 'a'&'b', carotenoids and xanthophyll), photochemical phase - pigment systems, cyclic and non-cyclic photophosphorylation, chemiosmotic

hypothesis; biosynthetic phase - C_3 and C_4 cycles – graphic representation in correct sequence (carboxylation, glycolytic reversal and regeneration of pentose); Differences between C_3 and C_4 plants, C_3 and C_4 cycles, Photosystems I and II, Photorespiration pathway in brief - explanation of how RuBP carboxylase acts as RuBP oxygenase. Kranz anatomy. Blackman's Law of limiting factors, factors affecting photosynthesis.

(ii) Respiration in Plants

Exchange of gases; cellular respiration - glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); energy relations - number of ATP molecules generated; amphibolic pathways; respiratory quotient.

Types of respiration; mechanism of respiration: glycolysis, Krebs' cycle, ETS (only flowchart). Oxidative phosphorylation – definition; Brief idea of fermentation and Amphibolic pathway. Definition of respiratory quotient and RQ values of carbohydrates, proteins and fats.

(iii) Plant Growth and Development

Seed germination; phases of plant growth; plant growth rate; differentiation, dedifferentiation and redifferentiation; sequence of developmental processes in a plant cell; growth regulators - auxin, gibberellin, cytokinin, ethylene, ABA.

Definition of seed dormancy and quiescence; causes and methods of breaking seed dormancy; definition of hypogeal, epigeal and viviparous germination with two examples of each. A brief idea about differentiation, dedifferentiation and redifferentiation. Phases of growth in meristems, growth rate – definition; measurement of growth by direct method and use of auxanometer, factors affecting growth.

Discovery and physiological role of growth regulators in plants (such as auxins, gibberellins, cytokinins, ethylene and abscisic acid – four effects of each); application of growth regulators.

5. Human Physiology

(i) Breathing and exchange of gases.

Respiratory organs in animals (recall only); Respiratory system in humans; mechanism of breathing - exchange of gases, transport of gases and regulation of breathing, respiratory volumes; disorders related to respiration.

Organs involved in respiration; mechanism of pulmonary gas exchange; breathing process should be explained showing the action of diaphragm and intercostal muscles, regulation of breathing ; transport of oxygen in the blood, oxyhaemoglobin dissociation curve; transport of CO_2; chloride shift, pulmonary air volumes and lung capacities; disorders of respiratory system such as - asthma, emphysema, occupational respiratory disorders.

(ii) Body fluids and circulation.

Composition of blood, blood groups, coagulation of blood; composition of lymph and its functions; human circulatory system - structure of human heart and blood vessels; cardiac cycle, cardiac output, ECG; double circulation; regulation of cardiac activity; disorders of circulatory system.

Composition of blood plasma, functions of plasma proteins, blood corpuscles. Importance of ABO groups in blood transfusion, Rh factor and its importance in transfusion and pregnancy; clotting of blood to be taught briefly; lymphatic system – a brief idea of lymph (composition and function), Difference between closed and open vascular system; external and internal structure of heart; working of the heart and blood flow through the heart during different phases should be described under the following headings - auricular systole, auricular diastole, ventricular systole, ventricular diastole and joint diastole; definition of stroke volume and cardiac output, regulation of heart beat, ECG; arterial blood pressure (systolic and diastolic), double circulation. The internal structure of artery, vein and capillary.

Importance of ABO groups in blood transfusion, Rh factor and its importance in transfusion and pregnancy; clotting of blood to be taught briefly; lymphatic system – a brief idea of lymph (composition and function), lymphatic capillaries and lymph nodes; disorders of the circulatory system such as hypertension, coronary artery disease, angina pectoris and heart failure.

(iii) Excretory products and their elimination.

Modes of excretion - ammonotelism, ureotelism, uricotelism; human excretory system - structure and function; urine formation, osmoregulation; regulation of kidney function, renin - angiotensin, atrial natriuretic factor, ADH; role of erythropoietin; role of other organs in excretion; disorders of the excretory system - uraemia, renal failure, renal calculi, nephritis; dialysis and artificial kidney, kidney transplant.

Define, differentiate and explain the terms ammonotelism, ureotelism and uricotelism; external and internal structure of the kidney (L.S.); structure of nephron; physiology of urine formation - ultra filtration, selective reabsorption and active (tubular) secretion. Counter current system, regulation of urine formation, definition of micturition, renin-angiotensin-aldosterone system, role of atrial natriuretic factor, ADH and erythropoietin.

Role of skin, liver and lungs in excretion. Homeostasis – definition. Disorders of the excretory system - uraemia, renal failure, renal calculi, nephritis.

Haemodialysis and artificial kidney. Kidney transplant.

(iv) Locomotion and Movement

Types of movement - ciliary, flagellar, muscular; skeletal muscles - contractile proteins and muscle contraction; skeletal system and its functions; joints; disorders of muscular and skeletal system.

Locomotion: Basic aspects of human skeleton (number and names of the bones of axial and appendicular skeleton).

Functions of human skeleton; different types of joints - their location and function; general properties of muscles; structure of skeletal muscle - sliding filament theory of muscle contraction; chemical events during muscle contraction; definition of summation, tetanus, rigor mortis, differences between red and white muscles.

Disorders of muscular and skeletal system: (i) Myasthenia gravis, (ii) Tetany, (iii Muscular dystrophy, (iv) Arthritis, (v) Osteoporosis, (vi) gout.

(v) Neural Control and Coordination

Neuron and nerves; nervous system in humans - central nervous system; peripheral nervous system and visceral nervous system; generation and conduction of nerve impulse.

Structure and functions of various parts of the brain and spinal cord; conduction of nerve impulses through nerve fibre (non-myelinated and myelinated) and through synapse.

(vi) Chemical Co-ordination and Integration

Endocrine glands and hormones; human endocrine system - hypothalamus, pituitary, pineal, thymus, thyroid, parathyroid, adrenal, GI tract, pancreas, gonads; mechanism of hormone action (elementary idea); role of hormones as messengers and regulators, hypo - and hyperactivity and related disorders; dwarfism, acromegaly, cretinism, goiter, exophthalmic goiter, diabetes mellitus and diabetes insipidus, Grave's disease, Addison's disease.

Brief idea of location of endocrine glands; role of hypothalamus; hormones secreted by different lobes of pituitary and their functions; feedback control of tropic hormones to be discussed giving examples; hormones of pineal, thymus, thyroid, parathyroid, pancreas, adrenal glands, GI tract (gastrin, secretin, GIP, CCK-PZ) and gonads; mechanism of hormone action (through cAMP and steroid hormones only); effects of hypo secretion and hyper secretion of various hormones of the above mentioned glands.

Note: Diseases related to all the human physiological systems to be taught in brief.

PAPER II

PRACTICAL WORK – 15 Marks

1. Scientific Techniques

To study parts of a dissecting microscope and compound microscope.

The students should know all parts of dissecting and compound microscope and be able to handle the microscope independently.

2. Physiology

(i) Food tests: test for starch, glucose, sucrose, proteins and fats.

Food tests: tests should be reported in tabular form. Both positive and negative tests should be reported.

(ii) To study the effect of thawing, heat and alcohol on permeability of beet root cells.

To study the effect of heat on permeability of cell membrane of beet root cells: students should record the observations at very low temperature, room temperature and higher temperature to see the degree of leaching and conclude accordingly. Experiment on effect of alcohol on the permeability with regard to leaching.

(i) Separation of plant pigments from leaves by chromatography.

(ii) Effect of different carbon dioxide concentrations on the rate of photosynthesis.

(iii) Demonstration of plasmolysis (using *Rhoeo* leaf / onion bulb).

(iv) Demonstration of osmosis in living plant cells (potato osmoscope).

3. Morphology

(i) Morphology and modification of roots, stems and leaves.

Teachers can show examples of roots, stems and leaves modified for mechanical support, storage, reproduction or perennation – students should learn to identify and draw the specimens.

Leaves: phyllotaxy – alternate, opposite whorled (with an example of each), shape, venation, simple and compound.

(ii) Preparation of temporary slides of *Mucor* / *Rhizopus*.

The teacher should guide the students on the technique of culture, staining and mounting the material and then observing under the microscope. The students should also be able to make labelled diagrams and record observations.

4. Cytology

Preparation of temporary slides of -

(i) Onion peel (to study the plant cell)

(ii) Stages of mitosis in onion root tips.

Correct method of selecting the root tip, fixing, staining and mounting should be taught. Different stages should be observed first in low power and after locating the area, the students should see it under high power. Various stages should be drawn and labelled.

(iii) T.S of monocot and dicot stem.

(iv) T.S. of monocot and dicot root.

After staining and mounting the tissue students should be able to draw the diagram and label all the parts as seen under the low power of microscope.

5. Spotting: (Three minutes to be given for each spot which includes identification, drawing a labelled diagram and writing at least two characteristics).

(a) Identification of stained preparations of the following:

(i) Stages of meiosis.

(ii) Identification of mammalian blood cells.

(iii) Bacteria

(iv) *Spirogyra*

(v) *Amoeba*

(vi) Yeast

(b) Identification of the following specimens -

(i) Liverworts

(ii) Moss

(iii) Fern

(iv) *Pinus*

(v) Mushroom
(vi) One monocot plant – bamboo
(vii) One dicot plant – *Petunia*
(viii) Sponge
(ix) *Hydra*
(x) Tape worm
(xi) Leech
(xii) Silk Worm
(xiii) Rohu fish

*Students should be taught how to identify, draw, label and give **at least two** significantly visible characteristics, as observed, of each spot, in a given time of three minutes.*

(c) Comment on experimental set up studied in physiology.
(a) Osmosis
(b) Transpiration
(c) Photosynthesis
(d) Transpiration pull.

Students should identify (aim of the experiment), draw a labelled diagram of the physiological set-up and write observation and inference of the experiment within the allotted time i.e., 3 minutes.

PROJECT WORK AND PRACTICAL FILE – 15 Marks

Project Work – 10 Marks

Candidate is to creatively execute one project/assignment on any aspect of Biology. Preference is to be given to investigatory projects. Following is only a suggestive list of projects. Teachers may assign or students may choose any one project of their choice.

(i) Project related to experiment on any aspect of plant life/animal life.
(ii) Project related to any aspect of environment.
(iii) Diabetes.
(iv) Endocrine disorders.
(v) Yeast fermentation and production of alcohol or any other commercial industry dependant on plants and/or animals or their products.

In addition, students may be taught how to culture:

– Earthworms.
– Protozoans.
– Moulds.
– Setting up of an aquarium.

Suggested Evaluation Criteria for Project Work:

Format of the Project:

– Content
– Introduction
– Presentation (graphs, tables, charts, newspaper cuttings, diagrams, photographs, statistical analysis if relevant)
– Conclusion/ Summary
– Bibliography

Practical File – 5 Marks

Each practical done during the year, needs to be recorded by the student in the Practical file and the same must be checked, signed and dated by the teacher.

Teachers are required to assess students on the basis of the Biology Practical file maintained by them during the academic year.

SCIENTISTS AND THEIR CONTRIBUTIONS

1. Beijerinck – *Contagium vivum fluidum*
2. Carl Woese – Three domains of life
3. Engelmann – Action spectrum of photosynthesis
4. Ernst Mayr – Biological species concept
5. F.F. Blackman – Law of limiting factor
6. F W Went – Isolated Auxins
7. Farmer and Moore – Discovered meiosis
8. G.N. Ramachandran – Analysis of Protein structure
9. George Palade – Discovered ribosomes
10. Huxley and Niedergerke – Sliding filament theory
11. Ivanowsky – Discovered Tobacco Mosaic Virus
12. Karl Landsteiner – Blood groups
13. Katherine Esau – Anatomy of plants
14. Peter Mitchell – Chemiosmotic coupling hypothesis
15. Priestley – Plants restore oxygen in the air
16. Robert Brown – Discovered nucleus
17. Singer and Nicolson – Proposed fluid mosaic model of plasma membrane
18. Sutherland – cyclic AMP as second messenger
19. T. O. Diener – Discovered viroids

20. Thomas Addison – Father of endocrinology
21. Van Neil – Oxygen released during photosynthesis comes from water
22. W. M. Stanley – Crystallised TMV
23. Waldeyer – Coined the term chromosome
24. Whittaker – Five kingdoms of life
25. William Harvey – Discovered circulatory system

LIST OF ABBREVIATIONS TO BE STUDIED

1. 2,4-D – 2, 4-Dichlorophenoxy acetic acid
2. ABA – Abscisic Acid
3. ANF – Atrial Natriuretic Factor
4. CCK –Cholecystokinin
5. ECG – Electrocardiogram
6. ERV – Expiratory Reserve Volume
7. ETS – Electron Transport System
8. FAD – Flavin Adenine Dinucleotide
9. FRC – Functional Residual Capacity
10. GA – Gibberellic acid
11. GFR – Glomerular Filtration Rate
12. GIP – Gastric Inhibitory Peptide
13. IBA – Indole Butyric Acid
14. IRV – Inspiratory Reserve Volume
15. LHC – Light Harvesting Complex
16. NAA – Naphthalene Acetic Acid
17. NADPH – Nicotinamide Adenine Dinucleotide Phosphate (reduced)
18. OAA – Oxaloacetic Acid
19. PGA – Phosphoglyceric Acid
20. PGRs – Plant Growth Regulators
21. PPLO – Pleuro Pneumonia Like Organism
22. PZ – Pancreozymin
23. RQ – Respiratory Quotient
24. RUBISCO – Ribulose Bisphosphate Carboxylase Oxygenase
25. RuBP – Ribulose Bisphosphate
26. TMV – Tobacco Mosaic Virus

BIOLOGY (863)

CLASS XII

There will be two papers in the subject:

Paper I: *Theory: 3 hours ... 70 marks*

Paper II*: Practical: 3 hours ... 15 marks*

Project Work ... 10 marks

Practical File ... 5 marks

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PAPER I- THEORY: 70 Marks

S. No.	UNIT	TOTAL WEIGHTAGE
1.	Reproduction	16 Marks
2.	Genetics and Evolution	15 Marks
3.	Biology and Human Welfare	14 Marks
4.	Biotechnology and its Applications	10 Marks
5.	Ecology and Environment	15 Marks
TOTAL		**70 Marks**

PAPER I –THEORY – 70 Marks

All structures (internal and external) are required to be taught along with diagrams.

1. Reproduction

(i) Reproduction in Organisms

Reproduction, a characteristic feature of all organisms for continuation of species; modes of reproduction - asexual and sexual reproduction; asexual reproduction - binary fission, sporulation, budding, gemmule formation, fragmentation; vegetative propagation in plants.

Definition of life span; life span of a few organisms (banana, rice, rose, banyan, butterfly, fruit fly, tortoise, crocodile, parrot, crow, elephant, dog, horse, and cow).

Asexual reproduction – definition, types (binary fission in Amoeba and Paramoecium, budding in yeast and Hydra, conidia in Penicillium, zoospores in Chlamydomonas, gemmules in sponges), definition of clone.

Vegetative propagation – definition, vegetative propagules (tuber of potato, rhizome of ginger, bulbil of Agave, leaf buds of Bryophyllum, offset of water hyacinth, runner of grass, sucker of pineapple, bulb of onion).

Sexual reproduction: Plants – definition, phases of life cycle (juvenile/vegetative, reproductive and senescence), unusual flowering phenomenon (bamboo and Strobilanthes kunthiana). Animals – continuous and seasonal breeders (definition, differences and examples).

Events in sexual reproduction – pre-fertilisation (gametogenesis and gamete transfer in plants and animals), chromosome number in the cells of house fly, fruit fly, butterfly, human beings, rat, dog, maize, apple, onion, cat, rice, Ophioglossum; fertilization (definition, types - external and internal), post-fertilisation (embryogenesis), definition and example of parthenogenesis, differences between asexual and sexual reproduction.

(ii) Sexual reproduction in flowering plants

Flower structure; development of male and female gametophytes; pollination - types, agencies and examples; outbreeding devices; pollen-pistil interaction; double fertilization; post fertilization events - development of endosperm and embryo, development of seed and formation of fruit; special modes - apomixis, parthenocarpy, polyembryony; Significance of seed dispersal and fruit formation.

Pre-fertilisation structures and events.

Structure of microsporangium, T.S. of anther microsporogenesis, structure and development of pollen grain, viability of pollen grain, economic importance of pollen grain. Pistil – structure of megasporangium (L.S. of anatropous ovule), megasporogenesis, structure and development of female gametophyte.

Types of pollination (autogamy, chasmogamy, cleistogamy, geitonogamy, xenogamy), adaptations in flowers pollinated by wind, water and insects. Advantages of self and cross-pollination. Contrivances for prevention of self-pollination. Pollen-pistil interaction in terms of incompatibility/compatibility, events leading to fertilisation, definition of triple fusion and double fertilization, changes in the ovary and ovule for seed and fruit formation. Significance of double fertilization. Apomixis, polyembryony, parthenocarpy to be explained briefly. Fruits to be classified into true and false, structure (L.S) of a typical fruit (mango and coconut); Internal structure of dicot (bean) and monocot (maize) seeds; definition, differences and examples of albuminous and non-albuminous seeds. Significance of seed and fruit formation. Significance of dispersal of seeds.

Post-fertilisation events - embryo formation (monocot and dicot); types of endosperm (cellular, nuclear and helobial); definition of perisperm.

(iii) Human Reproduction

Male and female reproductive systems; microscopic anatomy of testis and ovary; gametogenesis - spermatogenesis and oogenesis; menstrual cycle; fertilisation, embryo development upto blastocyst formation, implantation; pregnancy and placenta formation (elementary idea); parturition (elementary idea); lactation (elementary idea).

Organs of male and female reproductive system and their functions; internal structure of testis and ovary to be taught with the help of diagrams; gametogenesis- spermatogenesis (including spermiogenesis and spermiation) oogenesis; hormonal control of gametogenesis, structure of sperm and mature ovum, menstrual cycle - different phases and hormone action, differences between oestrous and menstrual cycle, menarche and menopause, physico-chemical events during fertilisation, implantation, embryonic development up to blastocyst formation, important features of human embryonic development (formation of heart, limbs, digits, appearance of hair on head, eyelashes, separation of eye lids, external genital organs and first movement of foetus with reference to time period) placenta and its functions. Parturition; lactation – hormonal control and importance.

(iv) Reproductive Health

Need for reproductive health and prevention of Sexually Transmitted Diseases (STDs); birth control - need and methods, contraception and medical termination of pregnancy (MTP); amniocentesis; infertility and assisted reproductive technologies - IVF, ZIFT, GIFT (elementary idea for general awareness).

Definition of reproductive health, programs of reproductive health (family planning, RCH), population explosion - role of government in controlling the population, contraceptives methods and their methods of action (natural-periodic abstinence, withdrawal or coitus interruptus, lactational amenorrhea; artificial – barriers, IUDs, oral pills, implants and surgical methods, definition of medical termination of pregnancy (MTP) and reasons for it; causes of infertility. Amniocentesis and its role in detecting genetic defects. Assisted reproductive technologies: IVF, IUT, ZIFT, ICSI, GIFT, AI, IUI. - definition and application only. Causes, symptoms and methods of prevention of sexually transmitted diseases (gonorrhoea, syphilis, genital herpes, chlamydiasis, genital warts, trichomoniasis, hepatitis- B, AIDS).

2. Genetics and Evolution

(i) Principles of inheritance and variation

Heredity and variation: Mendelian inheritance; deviations from Mendelism - incomplete dominance, co-dominance, multiple alleles and inheritance of blood groups, pleiotropy; elementary idea of polygenic inheritance; chromosomal theory of inheritance; chromosomes and genes; sex determination - in humans, fruit fly, birds and honey bee; linkage and crossing over; mutation; sex linked inheritance - haemophilia, colour blindness; Mendelian disorders in humans; chromosomal disorders in humans.

Explanation of the terms heredity and variation; Mendel's Principles of inheritance; reasons for Mendel's success; definition of homologous chromosomes, autosomes and sex chromosomes; alleles – dominant and recessive; phenotype; genotype; homozygous; heterozygous, monohybrid and dihybrid crosses; back cross and test cross, definitions to be taught with simple examples using Punnett square. Incomplete dominance with examples from plants (snapdragon - Antirrhinum) and co-dominance in human blood group, multiple alleles – e.g. blood groups, polygenic inheritance with one example of inheritance of skin colour in humans (students should be taught examples from human genetics through pedigree charts. They should be able to interpret the patterns of inheritance by analysis of pedigree chart). Biological importance of Mendelism. Pleiotropy with reference to the example of Phenylketonuria (PKU) in human beings and

starch synthesis in pea seeds. Chromosomal theory of inheritance; autosomes and sex chromosomes (sex determination in humans, fruit fly, birds, honey bees and grasshopper), sex-linked inheritance - with reference to Drosophila (colour of body-yellow and brown; and colour of eyes-red and white), and man (haemophilia and colour blindness), definition and significance of linkage and crossing over. Mutation: spontaneous, induced, gene (point – transition, transversion and frame-shift); chromosomal aberration: euploidy and aneuploidy; human genetic disorders: phenylketonuria, thalassaemia, colour blindness, sickle cell anaemia; chromosomal disorders: Down's syndrome, Klinefelter's syndrome, Turner's syndrome.

(ii) Molecular basis of Inheritance

Search for genetic material and DNA as genetic material; structure of DNA and RNA; DNA packaging; DNA replication; central dogma; transcription, genetic code, translation; gene expression and regulation - lac operon; human and rice genome projects; DNA fingerprinting.

Structure of eukaryotic chromosomes with reference to nucleosome; properties of genes such as ability to replicate, chemical stability, mutability and inheritability. Search for DNA as genetic material - Griffith's experiment, Hershey and Chase's experiment, Avery, McLeod and McCarty's experiment; double helical model of DNA (contributions of Miescher, Watson and Crick, Wilkins, Franklin and Chargaff); Differences between DNA and RNA; types of RNA (tRNA, mRNA and rRNA, snRNA, hnRNA); central dogma – concept only; reverse transcription (basic idea only), Meselson and Stahl's experiment, replication of DNA (role of enzymes, namely DNA polymerase and ligase), transcription, post-transcriptional processing in eukaryotes (splicing, capping and tailing). Intron, exon, cistron, (definitions only). Discovery and essential features of genetic code. Definition of codon. Protein synthesis - translation in prokaryotes. Gene expression in prokaryotes; lac operon in E. coli. Human Genome Project: goal; methodologies [Expressed Sequence Tags (EST), Sequence Annotation], salient features and applications. DNA finger printing – technique, application and ethical issues to be discussed briefly. Rice Genome Project (salient features and applications).

(iii) Evolution

Origin of life; biological evolution and evidences for biological evolution (palaeontology, comparative anatomy, embryology and molecular evidences); Darwin's contribution, modern synthetic theory of evolution; mechanism of evolution - variation (mutation and recombination) and natural selection with examples, types of natural selection; gene flow and genetic drift; Hardy - Weinberg's principle; adaptive radiation; human evolution.

Origin of life - abiogenesis and biogenesis, effect of oxygen on evolution to show that reducing atmosphere is essential for abiotic synthesis. Important views on the origin of life, modern concept of origin of life, Oparin Haldane theory, definition of protobionts, coacervates), vestigial organs; Miller and Urey experiment. Evidences of evolution: morphological evidences, definition and differences between homologous and analogous organs (two examples each from plants and animals). Embryological evidences – theory of recapitulation, definition and differences between ontogeny and phylogeny. Palaeontological evidence – definition of fossils. Geological time scale (with reference to dominant flora and fauna) Biogeographical evidence – definition of biogeography, molecular (genetic) evidences -for example genome similarity, universal genetic code; Darwin's finches (adaptive radiation).

Lamarckism: brief idea of Lamarck's theory, evidences in favour of Lamarckism such as evolution of long neck of giraffe to be discussed. Darwinism: salient features of Darwinism, contribution of Malthus, criticism of Darwinism. Examples of natural selection – Long neck of giraffe, industrial

melanism, resistance of mosquitoes to DDT and resistance of bacteria to antibiotics, Lederberg's replica plating experiment, Neo-Darwinism (Modern Synthetic Theory); Variation - causes of variation, Hugo de Vries theory of mutation - role of mutation in evolution; Hardy Weinberg's principle, factors affecting Hardy Weinberg equilibrium: gene migration or gene flow, genetic drift (Founder's effect, bottle-neck effect), mutation, genetic recombination and natural selection, types of natural selection (directional, disruptive and stabilizing). Evolution of man - three features of each of the ancestors Dryopithecus, Ramapithecus, Australopithecus, Homo habilis, Homo erectus, Homo neanderthalensis, Cro-magnon man and Homo sapiens leading to man of today.

3. Biology and Human Welfare

(i) Human Health and Diseases

Pathogens; parasites causing human diseases (common cold, dengue, chikungunya, typhoid, pneumonia, amoebiasis, malaria, filariasis, ascariasis, ring worm) and their control; Basic concepts of immunology - vaccines; cancer, HIV and AIDS; Adolescence - drug and alcohol abuse.

Communicable and non-communicable diseases; modes of transmission, causative agents, symptoms and prevention; viral diseases (common cold, chikungunya and dengue), bacterial diseases (typhoid, pneumonia, diphtheria and plague), protozoal diseases (amoebiasis, and malaria, graphic outline of life cycle of Plasmodium), helmintic diseases (ascariasis, and filariasis); fungal (ringworm); cancer - types of tumour (benign, malignant), causes, diagnosis and treatment, characteristics of cancer cells (loss of contact inhibition and metastasis).

Immunity (definition and types – innate and acquired, active and passive, humoral and cell-mediated), Interferons – definition, source and function; structure of a typical antibody molecule, types of antibodies - IgG, IgA, IgM, IgD and IgE (function and occurrence, e,g. in serum, saliva, colostrum); vaccination and immunisation, allergies and allergens – definition and general symptoms of allergies; autoimmunity, primary and secondary lymphoid organs and tissues, brief idea of AIDS – causative agent (HIV), modes of transmission, diagnosis (ELISA), symptoms, replication of retrovirus in the infected human cell (including diagram) and prevention.

Alcoholism and smoking - effects on health.

Drugs: effects and sources of opioids, cannabinoids, cocaine and barbiturates.

Reasons for addiction; prevention and control of alcohol and drug abuse.

(ii) Strategies for enhancement in food production

Improvement in food production: green revolution, plant breeding, tissue culture, single cell protein, biofortification, apiculture and animal husbandry.

Measures for proper maintenance of dairy farms and poultry farms; apiculture and pisciculture – definition, brief idea and advantages of each.

Animal breeding - brief idea of inbreeding, out-breeding, cross-breeding and artificial insemination, Multiple Ovulation Embryo Transfer Technology (MOET). Advantages of artificial insemination.

Plant breeding – a brief reference to green revolution. Steps in plant breeding (germplasm collection, evaluation, selection, cross hybridisation or artificial hybridisation (concept of emasculation and bagging), selection and testing of superior recombinants, testing, release and commercialisation of new cultivars), advantages of mutation breeding, examples of some Indian hybrid crops like wheat, rice, maize, sugarcane, millet. Definition of heterosis and inbreeding depression.

Application of plant breeding for (i) disease resistance [examples of some disease-resistant varieties of crops for example wheat (Himgiri), Brassica (Pusa swarnim), cauliflower (Pusa shubhra, Pusa snowball K

– 1), Cow pea (Pusa komal), chilli (Pusa sadabahar)],(ii) insect resistance [examples of some insect resistant varieties of crops – Brassica (Pusa Gaurav), flat bean (Pusa sem 2, Pusa sem 3), okra (Pusa sawani, Pusa A–4)], (iii) improved food quality (biofortification, e.g., wheat – Atlas 66, maize hybrids, iron fortified rice). Tissue culture (technique and application – micropropagation, somaclones, disease free plants and somatic hybridisation), single cell protein – source and significance.

(iii) Microbes in Human Welfare

In household food processing, industrial production, sewage treatment, energy generation and microbes as biocontrol agents and biofertilisers. Antibiotics.

Use of microbes in: (i) Household products: Lactobacillus (curd), Saccharomyces (bread), Propionibacterium (Swiss cheese); (ii) Industrial products: beverages (with and without distillation), antibiotics (Penicillin – discovery and use); sources (microbes) and uses of organic acids, alcohols and enzymes (lipase, pectinase, protease, streptokinase) in industry, source (microbes) and applications of Cyclosporin-A, Statins. (iii) Sewage treatment – primary and secondary treatment; (iv) Production of biogas (methanogens, biogas plant, composition of biogas and process of production); (v) Microbes as biocontrol agents (ladybird, dragonfly, Bacillus thuringiensis Trichoderma, Nucleopolyhedrovirus (Baculovirus), and (vi) Microbes as biofertilisers (Rhizobium, Azospirillum, Azotobacter, Mycorrhiza, Cyanobacteria), IPM, harmful effects of chemical pesticides.

4. Biotechnology and its Applications

(i) Biotechnology - Principles and processes

Genetic Engineering (recombinant DNA technology).

Definition and principles of biotechnology; isolation of genomic (chromosomal) DNA (from bacteria/plant cell/animal cell, by cell lysis), isolation of gene of interest (by electrophoresis), steps of formation of recombinant DNA, discovery, nomenclature, features and role of restriction enzymes (EcoRI, HindII) and role of ligase; cloning vectors (features of a good cloning vector, examples of cloning vectors like pBR322, Agrobacterium, retroviruses, bacterial artificial chromosome (BAC), yeast artificial chromosome (YAC)), methods of transfer of rDNA into a competent host, e.g. by direct-method (temperature shock), microinjection, gene gun, methods of selection of recombinants (antibiotic resistance, insertional inactivation/blue-white selection), cloning of recombinants, i.e., gene amplification (by in vivo or in vitro method - using PCR technique), bioreactor (basic features and uses of stirred tank and sparged tank bioreactors), downstream processing.

(ii) Biotechnology and its applications

Applications of biotechnology in health and agriculture: human insulin and vaccine production, stem cell technology, gene therapy; genetically modified organisms - Bt crops; transgenic animals; biosafety issues, biopiracy and biopatents.

In agriculture: for production of crops tolerant to abiotic stresses (cold, drought, salt, heat); pest-resistant crops (Bt-crops, RNAi with reference to Meloidogyne incognita); crops with enhanced nutritional value (golden rice).

In medicine: insulin, vaccine production, gene therapy - with reference to treatment of SCID, molecular diagnosis by PCR, ELISA and use of DNA/RNA probe.

Transgenic animals for bioactive products like alpha-1-antitrypsin for emphysema, alpha-lactalbumin; vaccine safety testing, chemical safety testing; study of diseases.

Role of GEAC, definition and two examples of biopiracy, biopatent; ethical issues.

5. Ecology and Environment

(i) Organisms and Populations

Organisms and environment: habitat and niche, population and ecological adaptations; population interactions -

mutualism, competition, predation, parasitism; population attributes - growth, birth rate and death rate, age distribution.

Definition of ecology; major biomes of India – Tropical rain forests, deciduous forests, deserts and sea coasts (their annual temperatures and precipitation). Definition of habitat and niche.

Definition of population; population attributes: sex ratio, types of age distribution pyramids for human population; definition of population density, natality, mortality, emigration, immigration, carrying capacity. Ways to measure population density. Calculation of natality and mortality.

Population growth: factors affecting population growth and population growth equation; growth models: exponential growth and logistic growth along with equations, graph and examples of the same; life history variations: definition of reproductive fitness and examples.

Population interactions – definition of mutualism, competition (interspecific, interference, competitive release and Gause's Principle of Competitive Exclusion), predation (adaptations in organisms to avoid predation), parasitism (ecto-, endo-, and brood parasites), commensalism, amensalism.

(ii) Ecosystem

Ecosystems: patterns, components; productivity and decomposition; energy flow; pyramids of number, biomass, energy; nutrient cycles (carbon and phosphorous); ecological succession; ecological services - carbon fixation, pollination, seed dispersal, oxygen release (in brief).

Definition and types of ecosystems; structure of ecosystem (brief idea about biotic and abiotic components).

Effects of abiotic factors (temperature, water, light, soil) on living organisms, definition of stenothermal, eurythermal, stenohaline and euryhaline), responses to abiotic factors (regulate, conform, migrate, suspend); ecological adaptations: morphological, physiological and behavioural in response to loss of water and extremes of temperature in plants and animals including humans. Allen's rule.

Structure and function of pond ecosystem; ecosystem functions: (i) Productivity – gross primary productivity (GPP), net primary productivity (NPP) and secondary productivity (ii) Decomposition (fragmentation, leaching, catabolism, humification and mineralization), factors affecting rate of decomposition (iii) Energy flow. Various types of food chains – grazing and detritus, food webs, trophic levels, ecological pyramids – energy, number and biomass (iv) Nutrient cycle – definition of biogeochemical cycles – gaseous cycle (Carbon) and sedimentary cycle (Phosphorous).

Definition of PAR, 10% Law, standing crop and standing state.

Succession: definition to explain the meaning, kinds of succession (hydrarch, xerarch; primary and secondary succession with examples), definition of pioneer community, climax community and sere; significance of ecological succession.

Ecological services and their cost.

(iii) Biodiversity and its Conservation

Concept of biodiversity; patterns of biodiversity; importance of biodiversity; loss of biodiversity; biodiversity conservation; hotspots, endangered organisms, extinction, Red Data Book, biosphere reserves, national parks, sanctuaries and Ramsar sites

Definition of biodiversity, few examples of each type of biodiversity - species, ecosystem and genetic. Global biodiversity and proportionate number of species of major taxa of plants, invertebrates and vertebrates; patterns of biodiversity (latitudinal gradients, species-area relationship – graph and equation), "rivet popper hypothesis", importance of species diversity to the ecosystem (narrowly utilitarian, broadly utilitarian, ethical terms).

Examples of some recently extinct organisms, causes of loss of biodiversity (habitat loss

and fragmentation, over-exploitation, alien species invasion, co-extinction).

Biodiversity conservation: In-situ methods - protected areas: biosphere reserves, national parks, wildlife sanctuaries, sacred groves; ex-situ methods - captive breeding, zoo, botanical gardens, cryopreservation, wild life safari, seed banks, tissue culture. Definitions and examples of each of the above. Hotspots, Ramsar sites and Red Data Book.

The place, year and main agenda of historic conventions on biological diversity (the Earth Summit and the World Summit).

(iv) Environmental Issues

Air pollution and its control; water pollution and its control; agrochemicals and their effects; solid waste management; radioactive waste management; greenhouse effect and climate change; ozone layer depletion; deforestation; any one case study as success story addressing environmental issue(s).

Definition of pollution and pollutant; environmental issues: air pollution and its control, major sources of gaseous and particulate pollutants, control devices for air pollution such as: scrubbers and electrostatic precipitators, catalytic converter, CNG, Bharat stages, noise pollution: harmful effects and control; Water pollution, major sources and its control, composition of waste water, thermal pollution, eutrophication - cultural or accelerated, BOD, effect of sewage discharge on BOD and dissolved oxygen content in river; case studies of waste water treatment (FOAM and EcoSan); Soil pollution – sources, effects and control, agrochemicals and their harmful effects, integrated organic farming, contribution of Ramesh Chandra Dagar, biomagnification and bioconcentration; solid waste management, Radioactive waste management, e-waste.

A brief understanding of the concept of deforestation (slash and burn agriculture or jhum cultivation's contribution), greenhouse effect. Impact of global warming in terms of climatic changes, rise in sea levels, melting of ice caps, El Nino effect; impact on animals and plants due to climate changes. Ozone depletion – causes, ozone hole, Dobson unit, effects on plants and animals, methods to control ozone depletion, Montreal protocol. The following case studies as success stories addressing environmental issues: Chipko Movement, Joint Forest Management, contribution of Ahmed Khan of Bangalore.

Main provisions of Environmental Acts — Environmental Protection Act, Water (prevention and control of pollution), Air (prevention and control of pollution act).

PAPER II

PRACTICAL WORK – 15 Marks

1) Taxonomy: Study floral characteristics through dissection of flowers, drawing floral formula and diagrams of following families:

(i) Malvaceae: type – China rose / Hollyhock.

(ii) Leguminosae: subfamily – Papilionaceae – type – Sweet pea/ Pea/ Bean/ *Sesbania*/ *Clitoria* (single flower).

(iii) Solanaceae: type – *Petunia* / *Datura* / Brinjal Flower / *Solanum nigrum*.

(iv) Liliaceae: type – Onion or Amaryllidaceae – type – Lily/Spider lily/ Tiger lily/ Tube rose/ *Gladiolus*.

(v) Cruciferae: type – mustard, candytuft (*Iberis* sp)

(vi) Compositae (Asteraceae): type sunflower, *Chrysanthemum*, *Cosmos*, *Dahlia*, Marigold.

(vii) Gramineae (Poaceae): type – wheat, corn, rice

Floral characteristics should be explained by dissection of flowers. Students should be taught how to cut vertical section of the flower and draw accurately labelled diagrams. The technique of drawing floral diagrams with the ***mother axis in the right position is necessary.*** *Floral formula should be correctly written. Identification of the correct family giving reasons, technique of cutting T.S. and L.S of ovary should be explained and accordingly correct labelled-diagram should be drawn.*

Students should know the examples of plants (belonging to each family) which are of economic importance. The examples of common names of plants must be supported with correct scientific names as well.

NOTE: In the examination, candidates will be tested on <u>any one</u> of the above families.

2) Simple biochemical and physiological experiments

(i) Study of arrangement/distribution of stomata in dicot and monocot leaves.

(i) Study of soils from ***two different sites***.

Collect soil samples from two different areas and make a comparative study of their texture, moisture content, humus content, water holding capacity and pH.

Guidelines for collection of soil samples:

- *Texture - loamy, sandy and clayey soil.*
- *Moisture content – Soil samples are to be collected from a dry place and a wet place. Alternatively, samples of soil can be dried to different degrees in oven/by keeping in sun.*
- *Humus Content – Collect one sample from roadside/barren land and one sample from garden/cultivated field.*
- *Water holding capacity – Pour given amount of water in known weight of soil sample and record the volume of water retained by the soil sample.*
- *pH – Add water to the soil sample and test with pH paper.*

Students should be taught to set up and demonstrate the experiments with correct diagram of the setup, record their observations methodically and give conclusions. This will give a clear idea of the physiological processes. Questions can be asked based on the above physiological processes studied.

(ii) To study the effect of enzyme action at three different temperatures and pH on starch solution.

Effect of enzyme (amylase/ diastase) action at three different temperatures (low- below 10^{o}C, optimum - 37^{o}C and high – above 70^{o}C) and pH (acidic, neutral and basic) on starch solution.

(iii) To isolate DNA from available plant material.

Isolation of DNA from spinach leaves, green pea seeds, pulp of banana and papaya.

Take half a ripe and peeled banana into a beaker and add 50 ml of extraction fluid (1.5gm table salt +10 ml liquid detergent +90 ml distilled water). Place the beaker in a water bath set at 60 °C for 15 minutes. Stir gently with a glass rod. Filter 5ml of cooled content into a clean test tube and add 5ml of cold 90% ethanol. DNA molecules separate out and appear as white fibres.

3) Slide preparation

(i) Germination of pollen grain in a nutrient medium.

(ii) T.S. of ovary of any locally available flower, to show marginal / axile placentation.

(iii) T.S. of a hydrophyte stem.

(iv) T.S. of a xerophytic leaf (*Nerium).*

(v) L.S. of monocot and dicot seed (soaked seeds of maize/wheat, pea/ bean.)

The technique of staining and mounting neatly should be explained. Students should also know how to make labelled outline diagrams. They should also be taught to identify the mount under low/ high power of microscope. ***Two*** *identifying features of the above need to be mentioned.*

4) Spotting: (three minutes to be given for each spot which includes identification, drawing a labelled diagram and writing at least two identifying characteristics).

NOTE: <u>Spotting must be done on a separate answer sheet during examination, which should be handed over to the Examiner immediately after spotting</u>.

(i) Identify and comment on the following:

(a) T.S. of ovary of mammal (Permanent slide).

(b) T.S. of testis of mammal (Permanent slide).

(c) Germinating pollen grain (slide/chart).

(d) T.S. of ovary to show the type of placentation (marginal, axile, basal (LS), parietal).

(e) T.S. of blastula / blastocyst of a mammal (chart/ slide).

(f) Whole mount of *Plasmodium* sporozoite (slide /chart).

(g) Whole mount of *Entamoeba histolytica* trophozoite (slide/chart).

(h) Preserved specimen/ chart/ model of *Ascaris.*

(ii) Comment upon ecological adaptations of plants and animals.

Models/ virtual images/ charts of one plant and one animal found in xeric and aquatic habitats. Examples: Hydrilla, cactus, fish and camel.

. (iii) Flowers adapted to pollination by different agencies – insect and wind.

Students should be able to identify the type of pollination of the given flower, draw the diagram of the flower and ***give two reasons*** *for the type of pollination. Example: Hibiscus and grass.*

Students should be taught how to identify, draw, label and give significantly visible characteristics as observed, of each spot, in a given time of three minutes. 'T.S.', 'model', 'whole mount', 'chart', 'image' of the specimen should be mentioned as a part of identification.

PROJECT WORK AND PRACTICAL FILE – 15 Marks

Project Work – 10 Marks

The project work is to be assessed by a Visiting Examiner appointed locally and approved by CISCE.

The candidate is to creatively execute **one** project/assignment on an aspect of biology. Preference is to be given to handwritten investigatory projects. Teachers may assign or students may choose any **one** project of their choice. Students can choose any other project besides the ones indicated in the list. Following is **only a suggestive** list of topics:

(i) Genetic disorders

(ii) Gene therapy

(iii) Human Genome Project

(iv) DNA fingerprinting

(v) Bio-piracy

(vi) Cancer.

(vii) AIDS/Hepatitis.

(viii) Drug addiction and community.

(ix) Role of micro-organisms in industry.

(x) Human population.

(xi) Mendelian Inheritance

(xii) Environmental resistance.

(xiii) Traditional and modern methods: Study of a few traditional methods of pest deterrence vis-a-vis modern methods of pest control - viability of traditional methods in today's scenario and limitations and dangers of modern methods.

(xiv) Role of agrochemicals in increasing food production.

Suggested Evaluation Criteria for Project Work:

Format of the Project:

– Content
– Introduction
– Presentation (graphs, tables, charts, newspaper cuttings, diagrams, photographs, statistical analysis if relevant)
– Conclusion/ Summary
– Bibliography

Practical File – 5 Marks

The Visiting Examiner is required to assess students on the basis of the Biology Practical file maintained by them during the academic year.

Each practical done during the year, needs to be recorded by the student in the Practical file and the same must be checked, signed and dated by the teacher.

SCIENTISTS AND THEIR CONTRIBUTIONS:

1. Oparin: Coacervates, Conditions on primitive earth were favourable for chemical evolution
2. Stanley Miller & Harold Urey: Recreated probable conditions on primitive earth
3. Ernst Haeckel: Proposed the recapitulation theory
4. Charles Darwin: Natural Selection

5. Lamarck: Inheritance of acquired characters
6. Hugo de Vries: Mutation
7. T. R. Malthus: Theory of Human Population Growth/ Essays on population
8. Alec Jeffrey: DNA finger printing
9. Temin and Baltimore: Reverse transcription.
10. Jacob, Monad and Lwoff: proposed Lac operon.
11. Watson and Crick: Structure of DNA
12. Nirenberg and Khorana: Genetic code
13. Benzer: Cistron, recon, muton
14. Gregor Mendel: Father of genetics
15. Sutton and Boveri: Chromosomal theory of inheritance
16. Hugo de Vries, Correns and Tschermack: Rediscovered Mendelism
17. T H Morgan: Linkage
18. P Maheshwari: Plant tissue culture
19. Henking: Discovered X-chromosome
20. F. Miescher: Isolated nucleic acid from pus cells, called Nuclein
21. Chargaff: Rule of equivalence in DNA structure
22. F. Griffith: Transformation in bacteria
23. Avery, MacLeod and McCarty: DNA is the genetic material
24. Hershey and Chase: DNA is the genetic material
25. Meselson and Stahl: Semi-conservative replication of DNA
26. G. Gamow: Triplet nature of codons
27. S Ochoa: discovered polynucleotide phosphorylase
28. Wallace: divided the Earth into biogeographical regions
29. M S Swaminathan: Green revolution in India
30. H Boyer: discovered Restriction Enzyme
31. S Cohen: method to transfer plasmid DNA in host cells
32. R. Mishra: Father of Indian Ecology
33. E. Wilson: coined the term Biodiversity
34. P Ehrlich: Rivet Popper Hypothesis
35. Sanger: DNA/Protein sequencing

LIST OF ABBREVIATIONS TO BE STUDIED

1. ADA- Adenosine Deaminase
2. CMI- Cell Mediated Immunity
3. CNG- Compressed Natural Gas
4. CPCB- Central Pollution Control Board
5. DDT – Dichloro diphenyl trichloro ethane
6. DFC- Detritus Food Chain
7. EFB- European Federation of Biotechnology
8. EST- Expressed Sequence Tags
9. ET- Embryo Transfer
10. GFC- Grazing Food Chain
11. GMO- Genetically Modified Organism
12. GPP- Gross Primary Productivity
13. hnRNA - Heterogeneous Nuclear Ribo Nucleic Acid
14. IARI- Indian Agricultural Research Institute
15. IMR- Infant Mortality Rate
16. IRRI- International Rice Research Institute
17. ICSI - Intra Cytoplasmic Sperm Injection
18. IUCD/IUD – Intra uterine contraceptive device
19. IUCN- International Union for Conservation of Nature and Natural Resources
20. IUI- Intra Uterine Insemination
21. IUT- Intra Uterine Transfer
22. JFM- Joint Forest Management
23. LAB- Lactic Acid Bacteria
24. MALT- Mucosal Associated Lymphoid Tissue
25. MMR- Maternal Mortality Rate
26. MOET- Multiple Ovulation Embryo Transfer Technology
27. NACO- National AIDS Control Organisation
28. NPP- Net Primary Productivity
29. PID- Pelvic Inflammatory Diseases
30. PKU- Phenyl ketonuria
31. RCH- Reproductive and Child Health Care Programmes
32. SCID – Severe Combined Immuno Deficiency
33. SNPs - Single Nucleotide Polymorphisms
34. snRNA- Small Nuclear Ribo Nucleic Acid
35. sRNA - Soluble Ribo Nucleic Acid
36. SSBP – Single Strand Binding Protein
37. UTR - Untranslated Region
38. VNTRs - Variable Number of Tandem Repeats

COMPUTER SCIENCE (868)

Aims (Conceptual)

(1) To understand algorithmic problem solving using data abstractions, functional and procedural abstractions, and object based and object-oriented abstractions.

(2) To understand: (a) how computers represent, store and process data at different levels of abstraction that mediate between the machine and the algorithmic problem solving level and (b) how they communicate with the outside world.

(3) To create awareness of ethical issues related to computing and to promote safe, ethical behavior.

(4) To make students aware of future trends in computing.

Aims (Skills)

To devise algorithmic solutions to problems and to be able to code, validate, document, execute and debug the solution using the Java programming system.

CLASS XI

There will be two papers in the subject:

Paper I: *Theory……..* *3 hours…70 marks*

Paper II: *Practical……..* *3 hours…30 marks*

PAPER I –THEORY – 70 MARKS

SECTION A

Basic Computer Hardware and Software

1. Numbers

Representation of numbers in different bases and interconversion between them (e.g. binary, octal, decimal, hexadecimal). Addition and subtraction operations for numbers in different bases.

Introduce the positional system of representing numbers and the concept of a base. Discuss the conversion of representations between different bases using English or pseudo code. These algorithms are also good examples for defining different functions in a class modelling numbers (when programming is discussed). For addition and subtraction (1's complement and 2's complement) use the analogy with decimal numbers, emphasize how carry works (this will be useful later when binary adders are discussed).

2. Encodings

(a) Binary encodings for integers and real numbers using a finite number of bits (sign-magnitude, 2's complement, mantissa-exponent notation).

Signed, unsigned numbers, least and most significant bits. Sign-magnitude representation and its shortcomings (two representations for 0, addition requires extra step); two's-complement representation. Operations (arithmetic, logical, shift), discuss the basic algorithms used for the arithmetic operations. Floating point representation: normalized scientific notation, mantissa-exponent representation, binary point (discuss trade-off between size of mantissa and exponent). Single and double precision.

(b) Characters and their encodings (e.g. ASCII, ISCII, Unicode).

Discuss the limitations of the ASCII code in representing characters of other languages. Discuss the Unicode representation for the local language. Java uses Unicode, so strings in the local language can be used (they can be displayed if fonts are available) – a simple table lookup for local language equivalents for Latin (i.e. English) character strings may be done. More details on Unicode are available at www.unicode.org.

3. Propositional logic, Hardware implementation, Arithmetic operations

(a) Propositional logic, well-formed formulae, truth values and interpretation of well formed formulae, truth tables.

*Propositional variables; the common logical connectives ((not)(negation), ∧ (and)(conjunction), ∨ (or)(disjunction), ⇒ (implication), ⇔ (equivalence)); definition of a well-formed formula (wff); representation of simple word problems as wff (this can be used for motivation); the values **true** and **false**; interpretation of a wff;*

truth tables; satisfiable, unsatisfiable and valid formulae.

(b) Logic and hardware, basic gates (AND, NOT, OR) and their universality, other gates (NAND, NOR, XOR, XNOR), half adder, full adder.

Show how the logic in (a) above can be realized in hardware in the form of gates. These gates can then be combined to implement the basic operations for arithmetic. Tie up with the arithmetic operations on integers discussed earlier in 2 (a).

SECTION B

The programming element in the syllabus is aimed at algorithmic problem solving and **not** merely rote learning of Java syntax. The Java version used should be 5.0 or later. For programming, the students can use any text editor and the javac and java programs or any other development environment: for example, BlueJ, Eclipse, NetBeans etc. BlueJ is strongly recommended for its simplicity, ease of use and because it is very well suited for an 'objects first' approach.

4. Introduction to Object Oriented Programming using Java

Note that topics 5 to 12 should be introduced almost simultaneously along with Classes and their definitions.

5. Objects

(a) Objects as data (attributes) + behaviour (methods or methods); object as an instance of a class.

Difference between object and class should be made very clear. BlueJ (www.bluej.org) and Greenfoot (www.greenfoot.org) can be used for this purpose.

(b) Analysis of some real-world programming examples in terms of objects and classes.

Use simple examples like a calculator, date, number etc. to illustrate how they can be treated as objects that behave in certain well-defined ways and how the interface provides a way to access behaviour. Illustrate behaviour changes by adding new methods, deleting old methods or modifying existing methods.

(c) Basic concept of a virtual machine; Java Virtual Machine (JVM); compilation and execution of Java programs (the javac and java programs).

The JVM is a machine but built as a program and not through hardware. Therefore it is called a virtual machine. To run, JVM machine language programs require an interpreter. The advantage is that such JVM machine language programs (.class files) are portable and can run on any machine that has the java program.

(d) Compile time and run time errors; basic concept of an exception, the Exception class, try-catch, throw, throws and finally.

Differentiate between compile time and run time errors. Run time errors crash the program. Recovery is possible by the use of exceptions. Explain how an exception object is created and passed up until a matching catch is found. This behaviour is different from the one where a value is returned by a deeply nested method call.

6. Primitive values, Wrapper classes, Types and casting

Primitive values and types: byte, int, short, long, float, double, boolean, char. Corresponding wrapper classes for each primitive type. Class as type of the object. Class as mechanism for user defined types. Changing types through user defined casting and automatic type coercion for some primitive types.

Ideally, everything should be a class; primitive types are defined for efficiency reasons; each primitive type has a corresponding wrapper class. Classes as user defined types. In some cases types are changed by automatic coercion or casting – e.g. mixed type expressions. However, casting in general is not a good idea and should be avoided, if possible.

7. Variables, Expressions

Variables as names for values; named constants (final), expressions (arithmetic and logical) and their evaluation (operators, associativity, precedence). Assignment operation; difference

between left-hand side and right-hand side of assignment.

Variables denote values; variables are already defined as attributes in classes; variables have types that constrain the values it can denote. Difference between variables denoting primitive values and object values – variables denoting objects are references to those objects. The assignment operator = is special. The variable on the LHS of = denotes the memory location while the same variable on the RHS denotes the contents of the location e.g. i=i+2.

NOTE: Library functions for solving expressions may be used as and when required.

8. Statements, Scope

Statements; conditional (if, if else, if else if, switch case) ternary operator, looping (for, while, do while), continue, break; grouping statements in blocks, scope and visibility of variables.

Describe the semantics of the conditional and looping statements in detail. Evaluation of the condition in conditional statements.

Nesting of blocks. Variables with block scope, method scope, class scope. Visibility rules when variables with the same name are defined in different scopes.

9. Methods and Constructors

Methods and Constructors (as abstractions for complex user defined operations on objects), methods as mechanisms for side effects; formal arguments and actual arguments in methods; different behaviour of primitive and object arguments. Static methods and variables. The ***this*** operator. Examples of algorithmic problem solving using methods (number problems, finding roots of algebraic equations etc.).

*Methods are like complex operations where the object is implicitly the first argument. Operator **this** denotes the current object. Methods typically return values. Illustrate the difference between primitive values and object values as arguments (changes made inside methods persist after the call for object values). Static definitions as class variables and class methods visible and shared by all instances. Need for static methods and variables. Introduce the main method – needed to begin execution. Constructor as a special kind of method; the new operator; multiple constructors with different argument structures; constructor returns a reference to the object.*

10. Arrays, Strings

Structured data types – arrays (single and multi-dimensional), strings. Example algorithms that use structured data types (searching, finding maximum/minimum, sorting techniques, solving systems of linear equations, substring, concatenation, length, access to char in string, etc.).

Storing many data elements of the same type requires structured data types – like arrays. Access in arrays is constant time and does not depend on the number of elements. Sorting techniques (bubble, selection, insertion), Structured data types can be defined by classes – String. Introduce the Java library String class and the basic operations on strings (accessing individual characters, various substring operations, concatenation, replacement, index of operations).

SECTION C

11. Basic input/output Data File Handling (Binary and Text)

(a) Basic input/output using Scanner and Printer classes.

Input/output exceptions. Tokens in an input stream, concept of whitespace, extracting tokens from an input stream (String Tokenizer class). The Scanner class can be used for input of various types of data (e.g. int, float, char etc.) from the standard input stream. Similarly, the Printer class handles output. Only basic input and output using these classes should be covered.

Discuss the concept of a token (a delimited continuous stream of characters that is meaningful in the application program – e.g. words in a sentence where the delimiter is the blank character). This naturally leads to the idea of delimiters and in particular whitespace and user defined characters as delimiters. As an example show how the StringTokenizer class allows one to extract a sequence of tokens from a string with user defined delimiters.

(b) Data File Handling.

Need for Data file, Input Stream, Output Stream, Byte Stream (FileInputStream and FileOutputStream), Character Stream (FileReader, FileWriter), Operations- Creation, Reading, Writing, Appending, and Searching.

12. Recursion

Concept of recursion, simple recursive methods (e.g. factorial, GCD, binary search, conversion of representations of numbers between different bases).

Many problems can be solved very elegantly by observing that the solution can be composed of solutions to 'smaller' versions of the same problem with the base version having a known simple solution. Recursion can be initially motivated by using recursive equations to define certain methods. These definitions are fairly obvious and are easy to understand. The definitions can be directly converted to a program. Emphasize that any recursion must have a base case. Otherwise, the computation can go into an infinite loop.

13. Implementation of algorithms to solve problems

The students are required to do lab assignments in the computer lab concurrently with the lectures. Programming assignments should be done such that each major topic is covered in at least one assignment. Assignment problems should be designed so that they are sufficiently challenging and make the student do algorithm design, address correctness issues, implement and execute the algorithm in Java and debug where necessary.

Self-explanatory.

14. Packages

Definition, creation of packages, importing user defined packages, interaction of objects across packages.

Java Application Programming Interface (API), development of applications using user defined packages.

15. Trends in computing and ethical issues

(a) Artificial Intelligence, Internet of Things, Virtual Reality and Augmented Reality.

Brief understanding of the above and their impact on Society.

(b) Cyber Security, privacy, netiquette, spam, phishing.

Brief understanding of the above.

(c) Intellectual property, Software copyright and patents and Free Software Foundation.

Intellectual property and corresponding laws and rights, software as intellectual property.

Software copyright and patents and the difference between the two; trademarks; software licensing and piracy. free Software Foundation and its position on software, Open Source Software, various types of licensing (e.g. GPL, BSD).

Social impact and ethical issues should be discussed and debated in class. The important thing is for students to realise that these are complex issues and there are multiple points of view on many of them and there is no single 'correct' or 'right' view.

PAPER II: PRACTICAL – 30 MARKS

This paper of three hours duration will be evaluated internally by the school.

The paper shall consist of three programming problems from which a candidate has to attempt any one. The practical consists of the two parts:

(1) Planning Session

(2) Examination Session

The total time to be spent on the Planning session and the Examination session is three hours. A maximum of 90 minutes is permitted for the Planning session and 90 minutes for the Examination session. **Candidates are to be permitted to proceed to the Examination Session only after the 90 minutes of the Planning Session are over.**

Planning Session

The candidates will be required to prepare an algorithm and a hand-written Java program to solve the problem.

Examination Session

The program handed in at the end of the Planning session shall be returned to the candidates. The candidates will be required to key-in and execute the Java program on seen and unseen inputs individually on the Computer and show execution to the examiner. A printout of the program listing, including output results should be attached to the answer script containing the algorithm and handwritten program. This should be returned to the examiner. The program should be sufficiently documented so that the algorithm, representation and development process is clear from reading the program. Large differences between the planned program and the printout will result in loss of marks.

Teachers should maintain a record of all the assignments done as part of the practical work throughout the year and give it due credit at the time of cumulative evaluation at the end of the year. Students are expected to do a **minimum** of twenty assignments for the year and **ONE** project based on the syllabus.

LIST OF SUGGESTED PROJECTS:

PRESENTATION / MODEL BASED/ APPLICATION BASED

1. Creating an expert system for road-traffic management (routing and re-routing of vehicles depending on congestion).
2. Creating an expert system for medical diagnosis on the basis of symptoms and prescribe a suitable treatment.
3. Creating a security system for age-appropriate access to social media.
4. Simulate Adders using Arduino Controllers and Components.
5. Simulate a converter of Binary to Decimal number systems using Arduino Controllers and Components.
6. Develop a console-based application using Java for Movie Ticket Reservation.
7. Develop a console-based application using Java to encrypt and decrypt a message (using cipher text, Unicode-exchange, etc).
8. Develop a console-based application using Java to find name of the bank and branch location from IFSC.
9. Develop a console-based application using Java to calculate taxable income (only direct tax).
10. Develop a console-based application using Java to develop a simple text editor (text typing, copy, cut, paste, delete).

EVALUATION

Marks (out of a total of 30) should be distributed as given below:

Continuous Evaluation

Candidates will be required to submit a work file containing the practical work related to programming assignments done during the year and **ONE** project.

Programming assignments done throughout the year	10 marks
Project Work (based on any topic from the syllabus)	5 marks

Terminal Evaluation

Solution to programming problem on the computer	15 Marks

(Marks should be given for choice of algorithm and implementation strategy, documentation, correct output on known inputs mentioned in the question paper, correct output for unknown inputs available only to the examiner).

CLASS XII

There will be two papers in the subject:

Paper I: *Theory……..* *3 hours….70 marks*

Paper II: *Practical……..* *3 hours….30 marks*

PAPER I –THEORY – 70 MARKS

SECTION A

1. Boolean Algebra

(a) Propositional logic, well formed formulae, truth values and interpretation of well formed formulae (wff), truth tables, satisfiable, unsatisfiable and valid formulae. Equivalence laws and their use in simplifying wffs.

*Propositional variables; the common logical connectives (~ (not)(negation), ∧ (and)(conjunction), ∨ (or)(disjunction), ⇒ (implication), ⇔ (biconditional); definition of a well-formed formula (wff); `representation of simple word problems as wff (this can be used for motivation); the values **true** and **false**; interpretation of a wff; truth tables; satisfiable, unsatisfiable and valid formulae.*

*Equivalence laws: commutativity of ∧, ∨; associativity of ∧, ∨; distributivity; De Morgan's laws; law of implication (p ⇒ q ≡ ~p ∨ q); law of biconditional ((p ⇔ q) ≡ (p ⇒ q) ∧ (q ⇒ p)); identity (p ≡ p); law of negation (~ (~p) ≡ p); law of excluded middle (p ∨~p ≡ **true**); law of contradiction (p∧~p ≡ **false**); tautology and contingency simplification rules for ∧, ∨. Converse, inverse and contra positive. Chain rule, Modus ponens.*

(b) Binary valued quantities; basic postulates of Boolean algebra; operations AND, OR and NOT; truth tables.

(c) Basic theorems of Boolean algebra (e.g. duality, idempotence, commutativity, associativity, distributivity, operations with 0 and 1, complements, absorption, involution); De Morgan's theorem and its applications; reducing Boolean expressions to sum of products and product of sums forms; Karnaugh maps (up to four variables).

Verify the laws of Boolean algebra using truth tables. Inputs, outputs for circuits like half and full adders, majority circuit etc., SOP and POS representation; Maxterms & Minterms, Canonical and Cardinal representation, reduction using Karnaugh maps and Boolean algebra.

2. Computer Hardware

(a) Elementary logic gates (NOT, AND, OR, NAND, NOR, XOR, XNOR) and their use in circuits.

(b) Applications of Boolean algebra and logic gates to half adders, full adders, encoders, decoders, multiplexers, NAND, NOR as universal gates.

Show the correspondence between Boolean methods and the corresponding switching circuits or gates. Show that NAND and NOR gates are universal by converting some circuits to purely NAND or NOR gates.

SECTION B

The programming element in the syllabus (Sections B and C) is aimed at algorithmic problem solving and **not** merely rote learning of Java syntax. The Java version used should be 5.0 or later. For programming, the students can use any text editor and the javac and java programs or any other development environment: for example, BlueJ, Eclipse, NetBeans etc. BlueJ is strongly recommended for its simplicity, ease of use and because it is very well suited for an 'objects first' approach.

3. Implementation of algorithms to solve problems

The students are required to do lab assignments in the computer lab concurrently with the lectures. Programming assignments should be done such that each major topic is covered in at least one assignment. Assignment problems should be designed so that they are sufficiently challenging. Students must do algorithm design, address correctness issues, implement and execute the algorithm in Java and debug where necessary.

Self explanatory.

4. Programming in Java (Review of Class XI Sections B and C)

Note that items 4 to 13 should be introduced almost simultaneously along with classes and their definitions.

While reviewing, ensure that new higher order problems are solved using these constructs.

5. Objects

(a) Objects as data (attributes) + behaviour (methods); object as an instance of a class. Constructors.

(b) Analysis of some real-world programming examples in terms of objects and classes.

(c) Basic input/output using Scanner and Printer classes from JDK; input/output exceptions. Tokens in an input stream, concept of whitespace, extracting tokens from an input stream (String Tokenizer class).

6. Primitive values, Wrapper classes, Types and casting

Primitive values and types: byte, int, short, long, float, double, boolean, char. Corresponding wrapper classes for each primitive type. Class as type of the object. Class as mechanism for user defined types. Changing types through user defined casting and automatic type coercion for some primitive types.

7. Variables, Expressions

Variables as names for values; named constants (final), expressions (arithmetic and logical) and their evaluation (operators, associativity, precedence). Assignment operation; difference between left hand side and right hand side of assignment.

8. Statements, Scope

Statements; conditional (if, if else, if else if, switch case, ternary operator), looping (for, while, do while, continue, break); grouping statements in blocks, scope and visibility of variables.

9. Methods

Methods (as abstractions for complex user defined operations on objects), formal arguments and actual arguments in methods; different behaviour of primitive and object arguments. Static method and variables. The **this** Operator. Examples of algorithmic problem solving using methods (number problems, finding roots of algebraic equations etc.).

10. Arrays, Strings

Structured data types – arrays (single and multi-dimensional), address calculations, strings. Example algorithms that use structured data types (e.g. searching, finding maximum/minimum, sorting techniques, solving systems of linear equations, substring, concatenation, length, access to char in string, etc.).

Storing many data elements of the same type requires structured data types – like arrays. Access in arrays is constant time and does not depend on the number of elements. Address calculation (row major and column major), Sorting techniques (bubble, selection, insertion). Structured data types can be defined by classes – String. Introduce the Java library String class and the basic operations on strings (accessing individual characters, various substring operations, concatenation, replacement, index of operations). The class StringBuffer should be introduced for those applications that involve heavy manipulation of strings.

11. Recursion

Concept of recursion, simple recursive methods (e.g. factorial, GCD, binary search, conversion of representations of numbers between different bases).

Many problems can be solved very elegantly by observing that the solution can be composed of solutions to 'smaller' versions of the same problem with the base version having a known simple solution. Recursion can be initially motivated by using recursive equations to define certain methods. These definitions are fairly obvious and are easy to understand. The definitions can be directly converted to a program. Emphasize that any recursion must have a base case. Otherwise, the computation can go into an infinite loop.

The tower of Hanoi is a very good example of how recursion gives a very simple and elegant solution where as non-recursive solutions are quite complex.

SECTION C

Inheritance, Interface, Polymorphism, Data structures, Computational complexity

12. Inheritance, Interfaces and Polymorphism

(a) Inheritance; super and derived classes; member access in derived classes; redefinition of variables and methods in subclasses; abstract classes; class Object; protected visibility. Subclass polymorphism and dynamic binding.

Emphasize inheritance as a mechanism to reuse a class by extending it. Inheritance should not normally be used just to reuse some methods defined in a class but only when there is a genuine specialization (or subclass) relationship between objects of the super class and that of the derived class.

(b) Interfaces in Java; implementing interfaces through a class; interfaces for user defined implementation of behaviour.

Motivation for interface: often when creating reusable classes some parts of the exact implementation can only be provided by the final end user. For example, in a class that sorts records of different types the exact comparison operation can only be provided by the end user. Since only he/she knows which field(s) will be used for doing the comparison and whether sorting should be in ascending or descending order be given by the user of the class.

Emphasize the difference between the Java language construct interface and the word interface often used to describe the set of method prototypes of a class.

13. Data structures

(a) Basic data structures (stack, queue, circular queue, dequeue); implementation directly through classes; definition through an interface and multiple implementations by implementing the interface. Conversion of Infix to Prefix and Postfix notations.

Basic algorithms and programs using the above data structures.

Data structures should be defined as abstract data types with a well-defined interface (it is instructive to define them using the Java interface construct).

(b) Single linked list (Algorithm and programming), binary trees, tree traversals (Conceptual).

The following should be covered for each data structure:

Linked List (single): insertion, deletion, reversal, extracting an element or a sublist, checking emptiness.

Binary trees: apart from the definition the following concepts should be covered: root, internal nodes, external nodes (leaves), height (tree, node), depth (tree, node), level, size, degree, siblings, sub tree, completeness, balancing, traversals (pre, post and in-order).

14. Complexity and Big O notation

Concrete computational complexity; concept of input size; estimating complexity in terms of methods; importance of dominant term; constants, best, average and worst case.

Big O notation for computational complexity; analysis of complexity of example algorithms using the big O notation (e.g. Various searching and sorting algorithms, algorithm for solution of linear equations etc.).

PAPER II: PRACTICAL – 30 MARKS

This paper of three hours' duration will be evaluated by the Visiting Examiner appointed locally and approved by CISCE.

The paper shall consist of three programming problems from which a candidate has to attempt any one. The practical consists of the two parts:

1. Planning Session
2. Examination Session

The total time to be spent on the Planning session and the Examination session is three hours. A maximum of 90 minutes is permitted for the Planning session and 90 minutes for the Examination session.

Candidates are to be permitted to proceed to the Examination Session only after the 90 minutes of the Planning Session are over.

Planning Session

The candidates will be required to prepare an algorithm and a hand written Java program to solve the problem.

Examination Session

The program handed in at the end of the Planning session shall be returned to the candidates. The candidates will be required to key-in and execute the Java program on seen and unseen inputs individually on the Computer and show execution to the Visiting Examiner. A printout of the program listing including output results should be attached to the answer script containing the algorithm and handwritten program. This should be returned to the examiner. The program should be sufficiently documented so that the algorithm, representation and development process is clear from reading the program. Large differences between the planned program and the printout will result in loss of marks.

Teachers should maintain a record of all the assignments done as part of the practical work through the year and give it due credit at the time of cumulative evaluation at the end of the year. Students are expected to do a **minimum of twenty-five** assignments for the year.

EVALUATION:

Marks (out of a total of **30**) should be distributed as given below:

Continuous Evaluation

Candidates will be required to submit a work file containing the practical work related to programming assignments done during the year.

Programming assignments done throughout the year (Internal Evaluation)	10 marks
Programming assignments done throughout the year (Visiting Examiner)	5 marks

Terminal Evaluation

Solution to programming problem on the computer	15 Marks

Marks should be given for choice of algorithm and implementation strategy, documentation, correct output on known inputs mentioned in the question paper, correct output for unknown inputs available only to the examiner.

NOTE:

Algorithm should be expressed clearly using any standard scheme such as a pseudo code.

EQUIPMENT

There should be enough computers to provide for a teaching schedule where at least three-fourths of the time available is used for programming.

Schools should have equipment/platforms such that all the software required for practical work runs properly, i.e. it should run at acceptable speeds.

Since hardware and software evolve and change very rapidly, the schools may have to upgrade them as required.

Following are the recommended specifications as of now:

The Facilities:

- A lecture cum demonstration room with a MULTIMEDIA PROJECTOR/ an LCD and O.H.P. attached to the computer.
- A white board with white board markers should be available.
- A fully equipped Computer Laboratory that allows one computer per student.
- Internet connection for accessing the World Wide Web and email facility.
- The computers should have a minimum of 1 GB RAM and a P IV or higher processor. The basic requirement is that it should run the operating system and Java programming system (Java compiler, Java runtime environment, Java development environment) at acceptable speeds.
- Good Quality printers.

Software:

- Any suitable Operating System can be used.
- JDK 6 or later.
- Documentation for the JDK version being used.
- A suitable text editor. A development environment with a debugger is preferred (e.g. BlueJ, Eclipse, NetBeans). BlueJ is recommended for its ease of use and simplicity.

SAMPLE TABLE FOR PRACTICAL WORK

S. No.	Unique Identification Number (Unique ID) of the candidate	Assessment of Practical File		Assessment of the Practical Examination (To be evaluated by the Visiting Examiner only)				TOTAL MARKS (Total Marks are to be added and entered by the Visiting Examiner)
		Internal Evaluation 10 Marks	Visiting Examiner 5 Marks	Algorithm	Java Program with internal Documentation	Hard Copy (printout)	Output	
				3 Marks	7 Marks	2 Marks	3 Marks	30 Marks
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

Name of the Visiting Examiner:_____

Signature: _____

Date:_____

SOCIALLY USEFUL PRODUCTIVE WORK AND COMMUNITY SERVICE

Emphasis should be placed on work practice and classroom discussions in these classes. A component of Contemporary Studies ***may be*** correlated with SUPW.

Extract from Learning to Do Towards a Learning and Working Society. Report of the National Review Committee on Higher Secondary Education" with special reference to vocationalisation.

The objectives, sample plan of work and the mode of operations of the part of the curriculum (SUPW) to be executed by the teachers and the students are briefly set forth in the following paragraphs.

1. Socially useful productive work (SUPW) which is of a practical nature and undertaken under appropriate supervision and planning, will help achieve, inter alia, the following objectives:

   (a) Inculcation of positive attitudes to work in the students;

   (b) Identifying themselves with the community by rendering Social and Community Service;

   (c) Development of the habit of co-operative work;

   (d) Making the community conscious of scientific advancements and help it develop a scientific outlook;

   (e) Learning to apply one's classroom and vocationalised knowledge to solve day-to-day problems of the community;

   (f) Participation in nation building activities; and

   (g) Realization of the goals of the state and national development.

2. To develop proper attitude towards rural development and community service, the pupils at the higher secondary education level must be provided motivation and training opportunities. They should be given orientation training for 4-5 days in social service, understand its meaning, method and outcomes, and the means of developing rapport with the local community. The connected people, in the fields in which pupils are interested, can be brought to the school campus to address and motivate the pupils. The Heads of the higher secondary schools can be trained in different areas and they can train their teachers in their own schools in motivating the pupils, planning the programmes, carrying out and evaluating them. The teachers should be 'all purpose' guides for the effective participation of pupils in the programme.

3. The Project areas for SUPW can be selected according to the convenience of each school, its location, rural or urban, its background and experiences. More particularly the selection of the area will depend on:

   (a) Nearness of the area to the school;

   (b) Co-operation of the selected community; and

   (c) Understanding the locally available programme.

   While selecting the area, the teachers should understand the extent of co-operation of the community and its interest in the welfare programmes. The project area should be one where resources for the activities can be easily mobilised, because the school and pupils cannot spend on transport or expensive programmes. Simple projects can be taken up by the pupils with the available resources and which are within the capacity of the pupils involved. The participation of the local people in all stages of the programme, is a must for the success of the programme.

4. In planning a programme, the following decisions are important: What is to be done, who will do it, for what it is, when and how it will be done. If the planning is to be successful, all the following components must be considered:

   (a) Baseline survey locating needs and resources;

   (b) Giving priorities to the needs;

   (c) Outlining the programme;

   (d) Conducting the programme;

   (e) Concluding the programme.

A simple survey should be conducted by the pupils in their selected project areas, to help them to understand the needs of the people, the resources available in the area, and decide what could be done by them. With the help of all the teachers in the school, and based on the needs of the people, programmes can be outlined for the specified period of work (two years) in the community. Annual work plans can be prepared by the teachers as a guidepost for both the teachers and the students. A sample plan on a savings campaign is given below.

A Sample Plan of Work (Savings Campaign)

Week	Purpose	Methods	Persons to be Involved	Place to be adopted
I	Contacting the village leaders and people.	Home Visits.	Pupils, teachers and local leaders.	Individual houses.
II & III	Baseline survey to learn the income and expenditure and savings pattern in the area.	Interview	Homemakers, teachers and pupils.	Individual houses.
IV	Introduce the need and method of savings.	Group meetings, charts, posters and exhibits.	People, District, Savings Officer. Pupils and teachers.	Community hall or School.
V	Explaining various methods of savings.	Home visits, Group discussion with charts and pamphlets	Pupils and teachers Gram Sevikas and Gram Sevaks	Individual houses.
VI	Helping them to reach the Post office.	Field visits, Discussions, Demonstrations.	Postmaster, leaders in the community, pupils and teachers.	Post Office.
VII	Educating the people on Bank Saving.	Lecture-cum-Discussion.	Representative from nearby bank, pupils and teachers.	School.
VIII	Helping people to go to the bank and open savings accounts.	Field Visits, Discussion.	Interested people, Bank Manager, Pupils and teachers.	Bank.
IX	Educating the people in economic improvement	Lecture-cum-Discussion.	Small Scale Industries Officer, Pupils and Teachers.	Community Hall.
X	Starting simple income-generating programmes.	Demonstration.	Pupils, Teachers. Concerned People.	Community Hall and individual houses.
XI	Follow-up (continued).	All methods and techniques.	Concerned people.	Appropriate places.

5. Utilization of available infrastructure for the planning, execution and evaluation of the programmes is important in order also to minimise the expenditure and effort. The teachers should know the infrastructure available and be aware as to how to make use of them for the success of the programme. The infrastructure available for the welfare of the community is:

    1. District Collectorate
    2. Panchayat Union
    3. Village Panchayat
    4. Elementary School
    5. Primary Health Centre
    6. Municipality
    7. Small Savings Organisation
    8. Field Publicity Office
    9. Sarvodaya Sangh
    10. Local Organisations, such as, Parent Teachers' Association and Service Clubs - such as, Rotary, Lion's, Jaycees and others.

    To get the assistance and co-operation of those who make up this infrastructure, they should be apprised and involved at all the stages of the programme development - from the planning, through execution to evaluation.

6. The programmes selected must be suitable to the age level and competencies of the pupils and the needs of the community. Both general types of productive programmes and specific productive projects related to the subject matter of each student can be undertaken. The following general programmes can be undertaken by all the pupils irrespective of their subjects (electives) of study:

    (a) Fact finding;
    (b) Tree Planting;
    (c) Cleanliness and Sanitation;
    (d) Deepening ponds, construction of contour-bounds, community halls, road laying;
    (e) Small Savings Drive;
    (f) Health and Nutrition Education;
    (g) Celebration of National Days and festivals;
    (h) Organising film shows;
    (i) Organising libraries/book banks and mobile laboratories;
    (j) Hospital work;
    (k) Conducting programmes in balwari (games and music);
    (l) Coaching children;
    (m) Adult literacy;
    (n) Camps in the adopted area.

    Students who are pursuing language studies should take up Adult Education under Socially Useful Productive Work.

7. The Socially Useful Productive Work should, as far as possible, be allied to the electives chosen by the students, allowing also for any other kind of work depending upon the facilities available in the neighbourhood. The students who are studying Home Science may, for instance, work with the community for improvement of the nutritional status of the population, utilising the local products for developing cheap and wholesome diets. The students of Chemistry may undertake useful work of soil fertilisers and water, removal of pollution, utilisation of wastes, etc. Those of Physics may similarly work on rural electrification, improvement of small and cottage industries, etc. Biology students may serve in primary health centres and promote other health measures or help farmers, horticulturists, etc., for improving productivity. Political Science students may work with Panchayat Administration, local bodies, etc., for purposes of improving various services to the community.

The above are illustrations of the kind of Socially Useful Productive Work which the students, pursuing academic studies, may undertake. Obviously, there are many more areas that can be tackled in one's own environment. A list of certain subject matter related activities is set forth:

(1) Indian Languages

(i) Writing short stories and skits.
(ii) Developing leadership qualities and through education debates.
(iii) Developing artistic tendency - painting, drawing and other fine arts.
(iv) Promoting national integration.
(v) Encouraging them to read newspapers - knowledge about current affairs.
(vi) Adult literacy and adult education.
(vii) Coaching school children.

(2) History

(i) Dramatisation programmes.

(ii) Screening historical films.

(iii) Publication of historical leaflets and booklets.

(iv) Organisation of exhibitions of historical value.

(v) Debates and oratorical competitions as regards the political set up of the country.

(vi) Discussions and utilisation of local resources.

(vii) Encouraging the pupils to adopt such hobbies as are of educational value.

(3) Geography

(i) Radio broadcasts on weather conditions.

(ii) Making the villagers to understand the radio broadcasts.

(iii) Working models of volcanoes and earthquakes.

(iv) Survey work of the lands and roads.

(v) Attending the Panchayat Union Meetings and discussions.

(4) Mathematics

(i) Encouraging the pupils to learn mathematics by pointing out its use in the world at present.

(ii) Helping the adults and unemployed to run a co-operative store selling goods at controlled price.

(iii) Teaching them to make toys with simple models like triangles, spheres etc.

(iv) Helping them to discriminate between British units, and the metric system.

(v) Helping them to be aware of the units and measurements so that they cannot be cheated in shops. This can be done by actually showing the weights, scales and meter scale.

(5) Physics

(i) Giving basic knowledge about how to prevent electric shock accidents.

(ii) Giving knowledge about how lightning and thunder occur and what are the uses of lightning and thunder and the thunder arrester.

(iii) Teaching how we receive sound from the radio which is relayed from the Radio Station.

(iv) Preparing hot water with the help of solar heat or energy.

(v) Giving knowledge about how to produce artificial rain.

(vi) Teaching how to get electricity from water and steam.

(vii) Giving basic knowledge about how to operate the machines like washing machine, grinding-machine, electric cookers, etc.

(viii) Giving knowledge about how sound is produced from various sound instruments.

(6) Chemistry

(i) Preparation of soap and washing soda.

(ii) Explaining the uses of Dettol and Phenyl for cleanliness.

(iii) Preparation of tincture and simple ointments for wounds.

(iv) Preparation of dyes.

(v) Explaining the preparation of bleaching powder.

(vi) Explaining the equipping techniques and use of gobar gas plant in the houses making use of animal waste.

(vii) Explaining the uses and preparation of ammonium nitrate.

(viii) Explaining the fixation of nitrogen.

(ix) Explaining the uses of insecticides.

(x) Demonstrating the method of purifying water.

(7) Biology

(i) Helping the farmers to get rid of insect pests.

(ii) Learning methods of vegetative propagation.

(iii) Introducing modern techniques of incubation in poultry.

(iv) Practicing the way of getting uniform fruiting and blossoming through simple techniques using chemicals (Hormones).

(v) Leathering of economically important animals.

(vi) Making students aware of economic Zoology.

(vii) Providing knowledge on crop rotation.

(viii) Making students aware of the various sources of nitrogen manure in the form of nitrogen yielding plants (legumes) and easily available cultures to increase the yield.

(ix) Making students aware of contamination.

(8) Home Science

(i) Raising a kitchen garden.

(ii) Helping the rural people to have poultry units and to do bee keeping.

(iii) Organising rural balwari.

(iv) Low-cost nutritious food-demonstration.

(v) Improving arts and crafts.

(vi) Make use of compost pits.

(vii) Pest control measures.

(viii) Nutrition education through various games.

8. Fifteen per cent of the working time is to be spent for Socially Useful Productive Work. It amounts to about 150 hours a year. The 150 hours can be distributed throughout the year according to the convenience of schools. Sometimes, if it is impossible to give them every week, a stretch of several hours could be given during the year, for a camp. But continuity should be assured in the work. Many adjustments have to be made in the school timetable to give the students and teachers free time to go to the work spot. The timings suitable for the students must also fit in with the timings of the people in the programme area. After the two-year's programme, even when a particular batch of students completes its courses and leaves, the school should plan for follow-up programmes in the areas, by subsequent batches of students.

9. The Heads of the institutions should nominate a senior teacher to be in charge and co-ordinate the entire programme for the school and guide the teacher-in-charge. All teachers in the school would be guiding the students of their own class in all aspects of the programme – planning, execution and evaluation. The Heads of the institutions should scrutinize the records and registers maintained by the students, teachers and teacher-in-charge (coordinator) of the programme. The work of the coordinator should be counted in the workload of the teacher.

ASSESSMENT

(CLASSES XI AND XII)

Evaluation is an important aspect of planning and execution of the Socially Useful Productive Work (including Community Services and an optional component of Contemporary Studies) programme in schools. From the beginning of the programme each step needs evaluation. An illustrative guide to the areas of assessment and weightage to be given is contained in the following paragraphs.

1. Selection of Socially Useful Productive Work (including Community Service and an optional component of Contemporary Studies)

Candidates will be required to select one craft and one service per year of preparation for the Examination, i.e. Classes XI and XII. In addition, candidates may also select topics under Contemporary Studies per year of preparation for the Examination.

2. Internal Assessment

The Internal Assessment will consist of assessment in (a) Socially Useful Productive Work (b) Community Service (c) Contemporary Studies *(if opted by candidates)*. The work undertaken by the candidates during the two-year preparation period in each year will be assessed and marked out of 100.

3. Socially Useful Productive Work

(i) This will be taken to mean work practice in craft. In contrast to community service it implies the making of articles of social use or practice of a skill.

(ii) The areas of assessment of Socially Useful Productive Work may be classified as follows:

		<u>Marks</u>
(1)	Preparation	10
(2)	Organisation	20
(3)	Skills	40
(4)	Research	20
(5)	Interest	10

(iii) *Preparation:* It is important to select a craft which is socially useful and within the candidates' capabilities. It may be necessary to visit localities where certain crafts are practiced and note details of the processes or methods involved.

(iv) *Organisation:* The candidates should be able to explain in writing the tools, materials and processes required as well as draw up a timetable/programme of work.

(v) *Skills:* The manipulative skills of the candidates should be assessed regularly from the finished product(s) and should include the candidates' abilities to follow the processes or methods of the craft.

(vi) *Research:* This is the candidate's ability to analyse a process or method and suggest/implement improvements as also improvise wherever necessary.

(vii) *Interest:* This is an assessment of the candidate's industriousness, constancy and conscientiousness with regard to the work undertaken. The candidates should be able to adhere to the timetable/programme of work drawn up by them.

(viii) *Record card:* This should be kept for each candidate and the assessment of Socially Useful Productive Work entered in it. A specimen of the record card is given below for guidance.

NAME OF THE SCHOOL

Internal Assessment Card for Socially Useful Productive Work

Name of Candidate:_____

Craft/Skill:_____

ASSESSMENT RECORD

Date of Assessment	**Areas of Assessment**									
	Preparation		**Organisation**		**Skills**		**Research**		**Interest**	
	Grade	Points	Grade	Points	Grade	Points	Grade	Points	Grade	Points

INTERPRETATION OF GRADES

Grade	*Standard*
A	Very Good
B	Good
C	Satisfactory
D	Fair
E	Unsatisfactory (Fail)

4. Community Service

(i) This will be taken to mean work done in the home, school and outside, which is beneficial to the community.

(ii) The areas of assessment of Community Service may be as under:

	Marks
(1) Preparation	10
(2) Organisation	20
(3) Skills	40
(4) Resourcefulness	20
(5) Interest	10

(iii) *Preparation*: It is important to select a service that will be beneficial to the community. It may be necessary to form teams or squads and to select a leader.

(iv) *Organisation* is the knowledge of the tools, materials and methods/processes by which the work can be done, and the ability to draw up a timetable, or programme of work.

(v) *Skills* are the manipulative skills of doing the work. The quality of the candidate's work should be assessed.

(vi) *Resourcefulness* is the ability to complete the work in spite of problems and difficulties and to improvise wherever necessary.

(vii) *Interest* is the assessment of the candidate's constancy, industriousness and conscientiousness in doing the work and their abilities to adhere to the timetable, or programme of work drawn up by them.

(viii) A record card on the lines suggested for Socially Useful Productive Work should be kept.

(ix) A **practical scheme** for day schools is given below:

(a) In the case of day-schools, parents should be involved in making their children aware of their responsibilities in the home and to persons in the area in which they live. They should be encouraged to render service in the home and to their neighbours. Such service may take the form of helping parents in cleaning the house, making the beds, assisting in the kitchen, cleaning the backyard, helping in the garden, visiting the sick, teaching a child, or children in the neighbourhood, and so on.

Experiments should be tried in every school in which there are day scholars. Parents should be asked to give each child a job of work to do, which will last between 20 minutes to half an hour *each* day.

(b) A diary should be kept for each child in which the parents enter this every day:

(i) Nature of work;

(ii) Time allotted;

(iii) Remark of the parent;

(iv) Signature of the parent.

Thus, it will be possible for the school to ensure that children do at least three and half-hours *of Socially Useful Productive Work and Community Service*, per week.

(c) The number of hours as far as the *Social Service* is concerned in the case of day scholars, will then be within the home and the neighbourhood and may rightly be termed 'Homework'.

The remarks to be entered by the parent should be specified so that they may be converted into grades.

(d) A suggested five points "remarks" scale is given below:

A -Very Good

B -Good

C -Satisfactory

D -Fair

E - Unsatisfactory (Fail)

(e) The class teacher should be required to enter the "grades" in a special register against each child.

4. Contemporary Studies

Pupils are to be provided a general appreciation of the topics given with a view to cultivate and inculcate values promoting sustainable societal practices. Assessment will be done on the basis of participation in class discussions. Grades may be awarded as for SUPW.

5. Submission of SUPW and Community Service Grades

Heads of schools will be responsible for correct entry of the SUPW (including Community Service) and Contemporary Studies (optional) result of each candidate in terms of the Grades A, B, C, D or E.

The grades must be submitted online through the CISCE's CAREERS portal within the stipulated due date.

CONTEMPORARY STUDIES (OPTIONAL)

(Recommended to form a component of SUPW)

The aim of this section is to provide to all students the ability to comprehend social transformations and develop in them the ability to utilize knowledge and skills to effectively address emerging opportunities. The student should learn:

(i) To analyse concepts and practices within socio-economic, political contexts in the society.

(ii) To critically examine and evaluate various development strategies and experiences so as to be able to generate a viewpoint of their own.

(iii) To understand the inter-relationships of development in the country, in the region and at the international levels in commerce, trade and socio-political areas.

(iv) To develop a challenging attitude to act on the social and environmental matters in order to introduce change for a sustainable social order.

(v) To appreciate the conflicts of interests between social political organizations at the national and international levels and develop a comprehensive appraisal of their impact on the individual.

CLASS XI

1. Emergence of new Society

- 'Greens' and 'Culture Creatives'.
- Emerging trends in modern society:

  Organic Foods

  Vegetarianism

  Feminism

  Decline of the industrial age practices

  Netizens

2. Atmosphere and Climate change

- What is the "greenhouse gas effect" and which are the "greenhouse gases"?
- Is global warming man-made?
- What are the likely consequences of global warming?
- What other climate changes are taking places?
- What measures can we take to mitigate or combat these changes?

3. Equity, Equality, Social justice

- Constitutional provisions.
- Present political aspirations.
- Social imbalances.
- Perspectives promoting sustainable society.

4. The Energy Debate

- Impact of burning fossil fuel on environment.
- Future of nuclear energy.
- Scope of fuel conservation.

5. Reaching Out

Types of communication networks and their utility – e-mail, facsimile, video conferencing; understanding of the Internet as a global knowledge base and communication network.

CLASS XII

1. Understanding the New World Order

- Spirituality, Science and Society:
  - (i) The co-relation and need for balanced appreciation for sustainable social order.
  - (ii) The emergence of higher consciousness and higher spiritual commitments for meaningful living.
  - (iii) Scientific dimensions of spirituality.
  - (iv) Emerging society promoting contradictions and paradoxes.
- North-South dialogue:
  - (i) Unequal distribution of economic wealth.
  - (ii) Exploitation of world governance; instruments for enhancing the North-South divide.
  - (iii) Labour practices in the creation of wealth. Child labour, women labour, bonded labour. Low wages and economic activity in India and a selected western country.
  - (iv) Towards practices enhancing sustainability of world trade practices.
- United Nation's declaration for the rights of women, minorities and the child.

  A critical understanding of the enshrined articles related to child, women and minorities rights.

2. Building People

- Privatisation vs Nationalization.
- The need for governments to govern and leave economic activities to the people; role of NGOs.
- Generation of financial resources to meet governmental expenses.
- Impact of privatisation on economic development with specific reference to Insurance, Telecommunications, Railways and Electricity.

3. Science and Technology

- Animal and human aggression:
  - (i) Human and non-human signals of aggression.
  - (ii) Weapons devised by man for offence and defence.
  - (iii) Nuclear weapons, control on weapons manufacture, sale to foreign powers.
  - (iv) Technology - does it make war more or less likely?
- Science and Technology as change agents:
  - (i) Effect of scientific developments on our lives - at work and at home.
  - (ii) Business on net – e-commerce, its feasibility and implications.
- Cosmology and space research:
  - (i) Current theories about the origins of the universe.
  - (ii) Probability of existence of Extra Terrestrial Intelligence.
- Emergence of new technologies and their appreciation:
  - (i) Non-Digital and Digital technology.
  - (ii) Communication technology.
  - (iii) Information technology.
- Biodiversity, Genetic Engineering and Cloning.
- Ecology, exploitation of natural resources.
- Interdependence of species and ecosystem and consequences of disturbing this equilibrium.

4. Dilemmas

- Patent Laws and their implications.
- Intellectual copyrights - ethical and moral dimensions.

PHYSICAL EDUCATION (875)

Aims:

1. To gain an understanding and insight into the modern and emerging concepts as well as future prospects of Physical Education.
2. To create awareness of the necessity for vigour and efficiency through physical fitness.
3. To facilitate physical, intellectual, emotional and social development of students.
4. To develop an understanding of the physiological, socio-cultural and psychological factors which influence Physical Education.
5. To create awareness of the necessity to develop a good posture and physical poise.
6. Give special attention to physically challenged children.
7. To create opportunities to develop *esprit de corps*, courtesy, sportsmanship, social skills, democratic conduct and ideals.
8. To develop skills of planning as well as practical skills in order to perform effectively.
9. To develop the ability to relate practice to classroom learning and vice-versa.

CLASS XI

*There will be **two** papers in the subject:*

Paper I: *Theory: 3 hours -----70 marks*

Paper II: *Practical Work ------ 30 marks*

PAPER I (THEORY) – 70 Marks

Note*: Details regarding evaluation of Practical Work are given at the end of Class XII. Practical Evaluation for Class XI is to be done by the Internal Examiner.*

SECTION – A

1. Concept of Physical Education

(i) Meaning of Physical Education, its aim and objectives.

Understanding of the term 'Physical Education'. Aims and objectives of Physical Education

Importance of Physical Education.

Need for Physical Education and how it is important.

(ii) Misconceptions about Physical Education and the relevance of Physical Education in the inter-disciplinary context (sports medicine, sports engineering, sports psychology, sports journalism, sports physiotherapy, sports nutritionist, sports fashion designing).

Misconceptions with respect to Physical Education; how Physical Education is related to various other disciplines as listed above.

(iii) Meaning of 'Play' and 'Recreation'.

Definition and importance of 'Play'; Characteristics of Play (freedom and time, space and spontaneity, enjoyment, intrinsic value).

Definition and importance of recreation.

(iv) Meaning and concept of 'Games and Sports'.

Meaning, definition and characteristics of 'Games and Sports'

2. Individual Aspects and Group Dynamics

(a) Interest and attitude.

- *Meaning and definition of the term Interest (inborn and acquired); Methods of developing interest (in Physical Education activities and programmes).*
- *Meaning and definition of the term Attitude (experience, derived, emotional challenge, profession); methods of forming attitude: by means of suggestions, by blindly accepting the social norms, by means of some intense emotional experiences, through participating in games and sports (forming attitude to win, attitude towards exercise, attitude towards physical fitness, fair play, obedience, discipline, etc.)*

(b) Motivation.

- *Introduction, meaning and definition of 'Motivation'.*
- *Types of Motivation: intrinsic and extrinsic.*
- *Methods of Motivation: praise or blame, competition, reward and punishment, setting clear goals, success and failure, record of progress, scholarships, social recognition, honour and glory.*

(c) Leadership.

- *Meaning and definition of the word 'Leader'.*
- *Desirable qualities of a Leader.*

3. Effects of Physical Exercise on Human Body Systems

Various systems and the effects of exercise and training on the following: skeletal system, muscular system, respiratory system, circulatory system and digestive systems.

(i) The skeletal and muscular system: Types of bones in the body, various types of joints and major movements; structural classification of muscles, structure and function of muscle.

(ii) Respiratory System: Meaning and types of respiration, organs of the respiratory system (nose, larynx, trachea, bronchi, diaphragm) and their functions.

(iii) Circulatory system: Meaning; Heart, its structure and functions; control of the heart rate; function and composition of blood, maintenance of blood supply.

(iv) Digestive System: Meaning, major organs (mouth, oesophagus, stomach, pancreas, liver, gallbladder, small intestine, large intestine) and functions of each.

(v) Effect of exercise and benefits of regular training on the above systems.

4. Nutrition, Weight Control & Exercise

(i) Nutrition Basics – Dietary Goals and basics of a Nutritious Diet.

Nutrition basics: Dietary Goals for various stages of growth (childhood, adolescence, adulthood, old age); Meaning of 'Nutritious Diet'.

(ii) Balanced Diet and role of balanced diet in performance.

Concept of a Balanced diet; elements and sources of a balanced diet; factors affecting balanced diet; Importance of Balanced diet in sports performance.

(iii) Obesity and weight control; Life time concept of weight control.

Meaning and definition of obesity; causes of Obesity, dangers of Obesity, prevention of Obesity through exercise and weight control.

Life-time concept of weight control – an understanding of how weight can be controlled through proper eating habits and exercise.

5. Physical Fitness & Wellness

(i) Physique, Physical Fitness and Wellness.

Understanding of the term 'Physique'; A basic understanding of the three body types (a) Endomorph (b) Mesomorph (c) Ectomorph.

Meaning and importance of Physical Fitness and Wellness.

(ii) Components of physical fitness and wellness.

Components of physical fitness:

Health related fitness such as Cardio vascular endurance, muscular endurance, strength; flexibility; body composition.

Skill related fitness: such as Cardio vascular endurance, muscular endurance, strength; flexibility; body composition, balance; coordination; agility; power, reaction time and speed (Candidates should be made to understand that skill related fitness includes all health related fitness components).

Components of Wellness: social, spiritual, physical, mental, emotional and intellectual (a basic understanding of each).

(iii) Factors affecting physical fitness and wellness.

Factors affecting physical fitness and wellness: Heredity, exercise (physical, mental and social benefits), illness, physical deformity, age and gender, diet, stress, living style, substance use (smoking, drugs, alcohol) and environment.

(iv) Tests and Measurements in Sports.

Basic understanding, importance and calculation of the following: Kraus Weber Test; Body Mass Index (BMI); Waist Hip Ratio; Measurement of Heart Rate; Rockport one-mile test.

6. Games and Sports – a global perspective

(i) Olympics as a Social force.

An understanding of how the Olympic games promote international understanding and appreciation of cultural diversity by providing a platform for athletes from all over the world to meet and compete, irrespective of their colour, race, creed and political beliefs.

(ii) History of Modern Olympics.

Motto of the Olympic games; Events held in modern Olympics; Where and when the first modern Olympics took place and where and when the upcoming Olympics will take place; significance of the colours used in the rings of the Olympic flag and what these rings signify. The founder of modern Olympics.

(iii) Asian Games.

Where and when the first Asian Games took place and where and when the upcoming Asian Games will take place. Events held in Asian Games; Countries participating in Asian Games.

SECTION B

Any **two** of the following games are to be studied:

Cricket, Football, Hockey, Basketball, Volleyball, Badminton, Tennis, Swimming, Athletics.

The following aspects should be studied for **each** of the **two games** selected by the candidate.

Rules and regulations of the game; Interpretation of laws of the game; Duties and responsibilities of the officials and players; Measurement and dimensions related to the game; Terminologies related to the game; Fundamental skills of the game; Strategies and formation of the game; Names and abbreviations of the National and Major International Tournaments linked with the game; Diagrams and dimensions of play area; Diagrams and dimensions of equipment related to the game.

The details for each game are given below:

CRICKET

- Knowledge of the game, strategies and tactics, and how to improve performance.
- Detailed understanding of the rules and regulations of the game. Diagrams of the field and pitch, and various fielding positions.
- Knowledge of the dimensions of the field, thickness of the lines, dimensions of pitch and complete specifications and markings on it. Equipment of the game with their length, width weight, thickness and material. Score board, scorer, sightscreen. Flood light
- Duties of the officials, before, during and after the match. Umpires and third umpire, requirements of the game, equipment needed, numbers of players, duty of coach, captain etc.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct tournaments, forfeitures, follow on, tie, power play, match fixing, duck worth rule, sledging, ball tampering.
- Basic skills and techniques. Batting (different types of shots, footwork, body position and actual bat movement. Bowling (run up, delivery stride, follow through, types of bowling variations, good line and length, grip action. Fielding positions, catching and throwing skills, Wicket keeping techniques, skills of getting the batsmen out.
- Different types of signals, extra runs, extra players, runner, substitute, provisions and restrictions, players equipment, danger area, various terms of cricket.
- Knowledge of associations and federations linked to the game. Important tournaments.

Abbreviations of associations and federations concerned with the game.

FOOTBALL

- Knowledge of the game, strategies and tactics, and how to improve performance.
- Detailed understanding of the rules and regulations of the game. Match time, extra time, tie breaker, sudden death, ball in play and out of play, importance of lines on the field. Various methods of starting and restarting the game. Substitution procedure, penalty cards and their importance.
- Knowledge of the dimensions of the field, thickness of the lines, dimensions of center circle, quarter circle, goal and penalty area, penalty arc and complete specifications and markings on it. Equipment of the game with their length, width, weight, thickness, material and dimensions. Diagram of goal post and field.
- Duties of the officials, requirements of the game, equipment needed, numbers of players, duty of coach, captain, assistant referees, technical officials, grounds men, ball boys, match organizers, technical area.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct tournaments, punishment on players, coaches.
- Basic skills and techniques (Passing - types of pass, ground lofted, chip, volley, angle of pass. Control (use of various surfaces-head chest, foot thigh). Dribbling (running with the ball, rhythm and pace, feints, body swerves, screening, beating an opponent. Heading the ball with intention of (attacking, defending, jumping, to head down, high, pass, score). Shooting skills with either foot, inside or outside, short and long range shots, swerving shots, volleys, penalty kicks, power and accuracy. Tackling skills - interception, jockeying for the ball, trapping by various body parts, position, tackle front, side, slide, recovery. Goalkeeping skills - stopping, watching, guiding the team, saving goal, dealing, catching, heading, kicking, punching, throwing, diving, anticipation, speed and reflexes.
- Principles of play-attack, depth, defence, penetration, sweeper systems, 4-4-2, 4-3-3, 4-2-4. Kick-off, corner kick, throw-in, goal kick, free kick, penalty kick. Importance of penalty arc, center circle and lines on the field.
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

HOCKEY

- Knowledge of the game, strategies and tactics, and how to improve performance.
- Detailed understanding of the rules and regulations of the game. Match time, extra time, tie breaker, sudden death, ball in play and out of play, penalty stroke, short corner, long corner, free hits, hit or push back, 16 yard hit, importance of lines on the field. Start and restart of the match.
- Knowledge of the dimensions and diagrams of the field and goalpost, thickness of the lines, dimensions and complete specifications and markings on it. Equipment of the game with their length, width, weight, thickness, material and dimensions. Protective equipment of the goalkeeper and players.
- Duties of the officials, requirements of the game, equipment needed, numbers of players, reserve bench, running substitution duty of coach, captain, assistant referees, ball boys, doctor, grounds men.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct tournaments, punishment on players, coaches.
- Basic skills and techniques (Passing - types of pass, ground lofted, chip, volley, angle of pass, push, scoop, flick, aerial ball. Receiving the ball – control, dribbling (running with the ball, rhythm and pace, feints, body swerves, screening, beating an opponent from the right to the left, right and behind. Shooting skills with Stick, inside or outside, short and long range shots, swerving shots, volleys, penalty, power and accuracy. Tackling skills - interception, jockeying for position. Goalkeeping skills - stopping, watching, guiding the team, saving goal, kicking, diving, anticipation, speed. reflexes.

- Principles of play-attack, depth, defence, penetration, team formations 1-2-3-5/1-1-3-4-2/1-1-3-3.
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

BASKETBALL

- Knowledge of the game, strategies and tactics, and how to improve performance.
- Detailed understanding of the rules and regulations of the game.
- Knowledge of the dimensions of the court, thickness of the lines, diagrams and dimensions of the court, full specifications of the ring, pole, boards and ball.
- Duties of the officials, table officials, referees, scorers, requirements of the game, equipment needed, numbers of players, reserve bench, duty of coach, captain, technical equipment team and player foul markers.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct tournaments.
- Basic skills and techniques, tactics and team skills Knowledge of basic skills, free throws stance (passing, dribble, shoot); Shooting (jump shot, layup, hook shot); passing (pass, signal, receive feint footwork, chest-pass, bounce pass, overhead pass, javelin pass. Footwork (pivot, 1 count and 2 count stop). One to one defence, fake and drive, pass and cut defence, types of defence, zone defence, and fast break.
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

VOLLEYBALL

- Knowledge of the game, strategies and tactics, and how to improve performance.
- Detailed understanding of the rules and regulations of the game.
- Knowledge of the dimensions and diagram of the court, thickness of the lines, dimensions within the court, full specifications of the net, pole and other equipment required for the game.
- Duties of the officials, table officials, referees, requirements of the game, equipment needed, numbers of players, reserve bench, duty of coach, captain, etc.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct tournaments, default by teams.
- Basic skills and techniques, tactics and team skills, Knowledge of basic skills, volley-two hand pass over the head forearm pass. The serve-underarm, over arm float, over arm jump, over arm top spin, round house jump. The smash - high set cross court, down the line, speed smash, tip the ball over the block. The block-line of defence, defence against smash, attack at set ball. Teamwork importance in both defence and attack. Understanding rotation, blocking and screening
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

BADMINTON

- Knowledge of the game, strategies and tactics, and how to improve performance.
- Detailed understanding of the rules and regulations of the game. Match time, extra time, tie, shuttle in play and out of play, importance of lines on the court, singles and doubles.
- Knowledge of the dimensions and diagram of the court, thickness of the lines. Equipment required for the game with their length, width weight, thickness, material and dimensions.

- Duties of the officials, requirements of the game, equipment needed, number of players, duty of coach, match organisers.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct tournaments, punishment on players, coaches, match points, etc.
- Basic skills and techniques - forehand or backhand, correct grip, smash, drop, drive, net play, return upshots and low/high/flick serves. Basic positioning for men and women rallies.
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

TENNIS

- Knowledge of the game, strategies and tactics, and how to improve performance.
- Detailed understanding of the rules and regulations of the game. Match time, deuce, advantage, tie foot fault. Ball in play and out of play. Dimensions and importance of lines on the court, singles and doubles.
- Knowledge of the dimensions and diagram of the court net, racket, thickness of the lines. Equipment required for the game with their length, width, weight, thickness, material and dimensions. Types of courts.
- Duties and number of officials, requirements of the game, number of players, duty of coach, match organisers.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct tournaments, punishment on players, coaches, match points, etc.
- Basic skills and techniques - forehand or backhand, chopper grip, correct grip, smash, drop, drive, net play, return upshots and low/high/flick serves. Basic positioning for men and women rallies. The racket grip-shake hand. Strokes - backhand push, forehand drive, forward push. Service - two bounce serve, high toss, forehand spin, backhand spin, long serve. Spin - forehand topspin, backhand topspin chopping blocking lobbing, follow through, placement of ball for each service.
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

SWIMMING

- Knowledge of competitive swimming events, activities, strategies and tactics, and how to improve performance (individual and team).
- Detailed understanding of the rules and regulations of various swimming events, strategies and tactics in chosen events. Planning performing and evaluating particular event.
- Knowledge of the dimension, depth and distance of the pool. Importance of starters and judges for start and finish of individual and medley races. Various officials in charge of conducting the events. Types of races, types of strokes, diving competitions, false start, individual and medley events. Stances for different strokes.
- Duties of the officials, table officials, referees, requirements of the game, equipment needed, numbers of players, reserve bench, duty of coach, physiotherapist, wind gauge operator, lifeguard, photo finish.
- Laws governing the game. Suspensions, penalisations, draws, fixtures, arrangements needed to conduct tournaments.
- Basic skills and techniques requiring control, balance, weight transfer, flow and clear body positions, complex sequence of movements and ability to perform showing high standards of precision control power speed and stamina, fitness and tactics to outwit the opponents. Warming up and cooling down safely, safety requirements for swimmers.
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

ATHLETICS

- Knowledge of track and field events, activities, strategies and tactics, and how to improve performance (individual and team).

- Detailed understanding of the rules and regulation of various events, strategies and tactics in chosen events. Planning performing and evaluating particular event.
- Knowledge of the dimension of the track. Width of the track. Measurement of 400 and 200 meters, relay and solo races. Equipment of athletes in various events dimensions and requirements. Importance of starters and judges for start and finish. Importance of staggers.
- Duties of the officials, table officials, referees, requirements of the game, equipment needed, numbers of players, reserve bench, duty of coach, physiotherapist, wind gauge operator, photo finish.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct meets. Rules and distances and requirements of various events.
- Basic skills and techniques requiring control, balance, weight transfer, flow and clear body positions, complex sequence of movements and ability to perform showing high standards of precision control power speed and stamina, fitness and tactics to outwit the opponents. Warming up and cooling down exercises.
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

CLASS XII

*There will be **two** papers in the subject:*

***Paper I:** Theory: 3 hours -----70 marks*

***Paper II:** Practical Work ------ 30 marks*

PAPER I (THEORY) – 70 Marks

SECTION A

1. Sociological Aspects of Physical Education

(i) Games and sports as man's cultural heritage.

An understanding that sports have been a part of our culture and tradition since time immemorial.

(ii) Development of the individual through games and sports.

Understanding how games and sports contribute in various ways towards the development of an individual.

(iii) Role of Physical Education in promoting national integration.

How Physical Education helps in promoting National Integration.

(iv) Physical Education and personality development.

The role of Physical education in development of personal qualities like an individual attitude, discipline, helpfulness, team spirit, patience, unity, friendship, etc.

2. Training Methods

(a) Meaning and importance of Sports Training.

Definition of Sports Training and its importance.

(b) Methods of training.

Methods of Training: Repetition, continuous & fartlek, and interval - Definition, purpose, advantages and procedure of each.

(c) Warming up, conditioning and cooling/limbering exercises.

- *Meaning of the terms 'warming up', 'conditioning' and 'cooling/limbering'.*
- *Basic exercises related to warming up, conditioning and cooling/limbering.*
- *Advantages of warming up, conditioning and cooling/limbering.*

(d) Isometric and Isotonic exercises.

Meaning, advantages and examples of each.

(e) Circuit Training.

Meaning and advantages of circuit training; procedure of conducting circuit training.

(f) Weight Training.

Meaning and advantages of weight training.

An understanding of how the above training methods help an individual in different sports and help develop strength, speed, stamina, skill, endurance.

3. Career Aspects in Physical Education

(i) Career options in Physical Education.

Professional sportsmen, sports manager, teacher/lecturer, sports coach, gym instructor, sports officials, sports events coordinators, sports journalist and commentator, sports software engineer, marketing and manufacturing of sports equipment.

(ii) Important institutions of Physical Education in India.

Functions and objectives of Netaji Subhash National Institute of Sports (N.S.N.I.S.), Sports Authority of India (S.A.I), International Olympic Committee (I.O.C), Indian Olympic Association (IOA), YMCA College of Physical Education (Chennai), Lucknow Christian College of Physical Education (LCCPE), Luxmibai National University of Physical Education (LNUPE).

Development of training facilities, coaching systems, influence of media and sponsors, campaigns like Health runs in creating awareness towards social evil causes and promoting physical fitness.

4. Competitions and Tournaments

(i) Tournaments and types of tournaments.

Candidates should be fully aware of:

- *the definition of 'tournament'.*
- *the types of tournaments: Fixtures, Knock-out, league matches (seeding and byes).*
- *merits and demerits of tournaments.*

- *objectives and importance of intramural and extramural competitions.*
- *Names of the National and International Federations/Bodies controlling the various tournaments/competitions.*

(iii) Difference between Professional and Amateur Players.

Self-explanatory.

Note: Candidates should be aware of the above, <u>for the past five years</u>, with respect to the games included in the syllabus.

5. Health Education & Health Problems

(a) Meaning and definition of 'Health' and 'Health Education'.

Meaning and definition of 'Health' (mental health and physical health) and 'Health Education'.

(b) Principles and importance of Health Education. Health problems and role of Health Education in solving them.

Principles and objectives of Health Education. Importance of Health Education for adults and the younger generation through formal and non-formal channels of education. Various prevalent Health Problems: Communicable diseases – meaning, examples and common mode of spread. Epidemics – meaning and examples; Water, noise and air pollution – causes and prevention; Occupational Health Hazards – meaning and examples.

Note: Details of specific diseases not required.

(c) Disability and Rehabilitation.

Causes of disability. General principles for prevention of disability;

Meaning and scope of Rehabilitation; services available for rehabilitation; role of the community and government organizations in rehabilitation programmes.

(d) Posture.

Meaning of posture.

Correct posture – meaning, importance of correct posture (standing, sitting, walking).

Common postural deformities: kyphosis, scoliosis, lordosis, flat foot, knock-knees, bowlegged, hunch back, round shoulders – meaning, causes and corrective measures for each.

(e) Personal hygiene and sleep requirements.

Personal hygiene: Meaning of personal hygiene, importance of personal hygiene for a healthy life style. Care of eyes, ears, feet, hair, skin, oral hygiene, nose and clothing.

Foot care: causes of corns, broken nails due to tight footwear; Causes of diseases like ring worm, athletes foot due to walking in wet areas; proper care of feet.

Sleep requirements: Sleep requirements for different age groups. Effects of insufficient sleep on human body.

(f) Substance Abuse.

Effects of use of alcohol and smoking on the individual and society.

Drugs: Meaning of 'drugs' and 'drug abuse'; Stimulants and Narcotics – Analgesics.

Awareness of the fact that use of certain drugs has been banned by World Anti-Doping Agency (WADA) and National Anti-Doping Agency (NADA) and reasons for the same.

6. Sports Injuries and First Aid

(i) Sports related injuries.

Types of sports related injuries: soft tissue injuries (contusion, abrasion, strain and sprain) bone injuries (fracture) and joint injuries (dislocation): causes and prevention of each.

(ii) Role of a sportsperson in prevention of sports related accidents.

Types of injuries due to: sudden movement; environment (hot, cold, wet and dry); lack of preparation (warm up, cool down); inadequate clothing, body protection; not following instructions; surface and facilities, equipment being unsafe. Role of individual in prevention of sports related accidents.

(iii) First Aid.

Meaning and importance of 'First Aid'. First Aid for various sports related injuries.

First Aid for cuts, grazes, strains, sprains, cramps, blisters, bruises, injuries of bone (fracture and dislocation); application of splints and Thomas splint; First Aid in drowning; Cardio Pulmonary Resuscitation (CPR) and Rest, Ice, Compression and Elevation (RICE).

SECTION B

Any **two** of the following games are to be studied:

Cricket, Football, Hockey, Basketball, Volleyball, Badminton, Tennis, Swimming, Athletics.

The following aspects should be studied for **each** of the **two games** selected by the candidate.

Rules and regulations of the game; Interpretation of laws of the game; Duties and responsibilities of the officials and players; Measurement and dimensions related to the game; Terminologies related to the game; Fundamental skills of the game; Strategies and formation of the game; Names and abbreviations of the National and Major International Tournaments linked with the game; Diagrams and dimensions of play area; Diagrams and dimensions of equipment related to the game.

The details for each game are given below:

CRICKET

- Knowledge of the game, strategies and tactics, and how to improve performance.
- Detailed understanding of the rules and regulations of the game. Diagrams of the field and pitch, and various fielding positions.
- Knowledge of the dimensions of the field, thickness of the lines, dimensions of pitch and complete specifications and markings on it. Equipment of the game with their length, width weight, thickness and material. Score board, scorer and sightscreen. Flood light.
- Duties of the officials, before, during and after the match. Umpires and third umpire, requirements of the game, equipment needed, numbers of players, duty of coach, captain etc.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct tournaments, forfeitures, follow on, tie, power play, match fixing, duck worth rule, sledging, ball tampering.
- Basic skills and techniques. Batting (different types of shots, footwork, body position and actual bat movement. Bowling (run up, delivery stride, follow through, types of bowling variations, good line and length, grip action. Fielding positions, catching and throwing skills, Wicket keeping techniques, skills of getting the batsmen out.
- Different types of signals, extra runs, extra players, runner, substitute, provisions and restrictions, players equipment, danger area, various terms of cricket.
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

FOOTBALL

- Knowledge of the game, strategies and tactics, and how to improve performance.
- Detailed understanding of the rules and regulations of the game. Match time, extra time, tie breaker, sudden death, ball in play and out of play, importance of lines on the field. Various methods of starting and restarting the game. Substitution procedure, penalty cards and their importance.
- Knowledge of the dimensions of the field, thickness of the lines, dimensions of center circle, quarter circle, goal and penalty area, penalty arc and complete specifications and markings on it. Equipment of the game with their length, width, weight, thickness, material and dimensions. Diagram of goal post and field.
- Duties of the officials, requirements of the game, equipment needed, numbers of players, duty of coach, captain, assistant referees, technical officials, grounds men, ball boys, match organizers, technical area.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct tournaments, punishment on players, coaches.
- Basic skills and techniques (Passing - types of pass, ground lofted, chip, volley, angle of pass. Control (use of various surfaces-head chest, foot thigh). Dribbling (running with the ball, rhythm and pace, feints, body swerves, screening, beating an opponent. Heading the ball with

intention of (attacking, defending, jumping, to head down, high, pass, score.) Shooting skills with either foot, inside or outside, short and long range shots, swerving shots, volleys, penalty kicks, power and accuracy. Tackling skills - interception, jockeying for the ball, trapping by various body parts, position, tackle front, side, slide, recovery. Goalkeeping skills - stopping, watching, guiding the team, saving goal, dealing, catching, heading, kicking, punching, throwing, diving, anticipation, speed and reflexes.

- Principles of play-attack, depth, defence, penetration, sweeper systems, 4-4-2, 4-3-3, 4-2-4. Kick-off, corner kick, throw-in, goal kick, free kick, penalty kick. Importance of penalty arc, center circle and lines on the field.
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

HOCKEY

- Knowledge of the game, strategies and tactics, and how to improve performance.
- Detailed understanding of the rules and regulations of the game. Match time, extra time, tie breaker, sudden death, ball in play and out of play, penalty stroke, short corner, long corner, free hits, hit or push back, 16 yard hit, importance of lines on the field. Start and restart of the match.
- Knowledge of the dimensions and diagrams of the field and goalpost, thickness of the lines, dimensions and complete specifications and markings on it. Equipment of the game with their length, width, weight, thickness, material and dimensions. Protective equipment of the goalkeeper and players.
- Duties of the officials, requirements of the game, equipment needed, numbers of players, reserve bench, running substitution duty of coach, captain, assistant referees, ball boys, doctor, grounds men.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct tournaments, punishment on players, coaches.
- Basic skills and techniques (Passing - types of pass, ground lofted, chip, volley, angle of pass, push, scoop, flick, aerial ball. Receiving the ball – control, dribbling (running with the ball, rhythm and pace, feints, body swerves, screening, beating an opponent from the right to the left, right and behind. Shooting skills with Stick, inside or outside, short and long range shots, swerving shots, volleys, penalty, power and accuracy. Tackling skills - interception, jockeying for position. Goalkeeping skills - stopping, watching, guiding the team, saving goal, kicking, diving, anticipation, speed. Reflexes.
- Principles of play-attack, depth, defence, penetration, team formations 1-2-3-5/1-1-3-4-2/1-1-3-3.
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

BASKETBALL

- Knowledge of the game, strategies and tactics, and how to improve performance.
- Detailed understanding of the rules and regulations of the game.
- Knowledge of the dimensions of the court, thickness of the lines, diagrams and dimensions of the court, full specifications of the ring, pole, boards and ball.
- Duties of the officials, table officials, referees, scorers, requirements of the game, equipment needed, numbers of players, reserve bench, duty of coach, captain .technical equipment team and player foul markers.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct tournaments.
- Basic skills and techniques, tactics and team skills Knowledge of basic skills, free throws stance (passing, dribble, shoot). Shooting (jump shot, layup, hook shot), passing (pass, signal, receive feint footwork, chest-pass, bounce pass, overhead pass, javelin pass. Footwork (pivot, 1 count and 2 count stop) One to one defence, fake and drive, pass and cut Defence, types of defence, zone defence, and fast break.
- Knowledge of associations and federations linked to the game. Important tournaments.

Abbreviations of associations and federations concerned with the game.

VOLLEYBALL

- Knowledge of the game, strategies and tactics, and how to improve performance.
- Detailed understanding of the rules and regulations of the game.
- Knowledge of the dimensions and diagram of the court, thickness of the lines, dimensions within the court, full specifications of the net, pole and other equipment required for the game.
- Duties of the officials, table officials, referees, requirements of the game, equipment needed, numbers of players, reserve bench, duty of coach, captain, etc.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct tournaments, default by teams.
- Basic skills and techniques, tactics and team skills Knowledge of basic skills, volley-two hand pass over the head forearm pass. The serve-underarm, over arm float, over arm jump, over arm top spin, round house jump. The smash - high set cross court, down the line, speed smash, tip the ball over the block. The block-line of defence, defence against smash, attack at set ball. Teamwork importance in both defence and attack. Understanding rotation, blocking and screening
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

BADMINTON

- Knowledge of the game, strategies and tactics, and how to improve performance.
- Detailed understanding of the rules and regulations of the game. Match time, extra time, tie, shuttle in play and out of play, importance of lines on the court, singles and doubles.
- Knowledge of the dimensions and diagram of the court, thickness of the lines. Equipment required for the game with their length, width weight, thickness, material and dimensions.
- Duties of the officials, requirements of the game, equipment needed, number of players, duty of coach, match organisers.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct tournaments, punishment on players, coaches, match points, etc.
- Basic skills and techniques - forehand or backhand, correct grip, smash, drop, drive, net play, return upshots and low/high/flick serves. Basic positioning for men and women rallies.
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

TENNIS

- Knowledge of the game, strategies and tactics, and how to improve performance.
- Detailed understanding of the rules and regulations of the game. Match time, deuce, advantage, tie foot fault. Ball in play and out of play. Dimensions and importance of lines on the court, singles and doubles.
- Knowledge of the dimensions and diagram of the court net, racket, thickness of the lines. Equipment required for the game with their length, width, weight, thickness, material and dimensions. Types of courts.

- Duties and number of officials, requirements of the game, number of players, duty of coach, match organisers.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct tournaments, punishment on players, coaches, match points, etc.
- Basic skills and techniques - forehand or backhand, chopper grip, correct grip, smash, drop, drive, net play, return upshots and low/high/flick serves. Basic positioning for men and women rallies. The racket grip-shake hand. Strokes - backhand push, forehand drive, forward push. Service - two bounce serve, high toss, forehand spin, backhand spin, long serve. Spin - forehand topspin, backhand topspin chopping blocking lobbing, follow through, placement of ball for each service.
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

SWIMMING

- Knowledge of competitive swimming events, activities, strategies and tactics, and how to improve performance (individual and team).
- Detailed understanding of the rules and regulations of various swimming events, strategies and tactics in chosen events. Planning performing and evaluating particular event.
- Knowledge of the dimension, depth and distance of the pool. Importance of starters and judges for start and finish of individual and medley races. Various officials in charge of conducting the events. Types of races, types of strokes, diving competitions, false start, individual and medley events. Stances for different strokes.
- Duties of the officials, table officials, referees, requirements of the game, equipment needed, numbers of players, reserve bench, duty of coach, physiotherapist, wind gauge operator, lifeguard, photo finish.
- Laws governing the game. Suspensions, penalisations, draws, fixtures, arrangements needed to conduct tournaments.
- Basic skills and techniques requiring control, balance, weight transfer, flow and clear body positions, complex sequence of movements and ability to perform showing high standards of precision control power speed and stamina, fitness and tactics to outwit the opponents. Warming up and cooling down safely, safety requirements for swimmers.
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

ATHLETICS

- Knowledge of track and field events, activities, strategies and tactics, and how to improve performance (individual and team).
- Detailed understanding of the rules and regulation of various events, strategies and tactics in chosen events. Planning performing and evaluating particular event.
- Knowledge of the dimension of the track. Width of the track. Measurement of 400 and 200 meters, relay and solo races. Equipment of athletes in various events dimensions and requirements. Importance of starters and judges for start and finish. Importance of staggers.
- Duties of the officials, table officials, referees, requirements of the game, equipment needed, numbers of players, reserve bench, duty of coach, physiotherapist, wind gauge operator, photo finish.
- Laws governing the game. Suspensions, penalisations, draws, match fixtures, arrangements needed to conduct meets. Rules and distances and requirements of various events.
- Basic skills and techniques requiring control, balance, weight transfer, flow and clear body positions, complex sequence of movements and ability to perform showing high standards of precision control power speed and stamina, fitness and tactics to outwit the opponents. Warming up and cooling down exercises.
- Knowledge of associations and federations linked to the game. Important tournaments. Abbreviations of associations and federations concerned with the game.

PRACTICAL WORK - 30 Marks

No question paper for practical work will be set by CISCE.

The Practical Work will be evaluated in two parts as follows:

1.	Continuous Evaluation (by the Teacher)	10 marks
2.	Practical Evaluation (by Visiting Examiner)	20 marks

1. CONTINUOUS EVALUATION (by the Teacher): 10 Marks

Continuous evaluation will be done by the teacher(s) responsible for preparing the candidate for the examination, in *two of the following games and activities of the candidate's choice*:

Athletics, Cricket, Hockey, Football, Volleyball, Softball, Basketball, Tennis, Badminton, Swimming, Dancing, Gymnastics, Yoga.

Continuous Evaluation will include the following:

A.	File Work done throughout the year on any two games/activities.	4 marks
B.	Participation and performance of the candidate, throughout the year, in at least any two games/activities of his/her choice.	3 marks
C.	Physical Efficiency Tests.	3 marks

2. PRACTICAL EVALUATION (by the Visiting Examiner): 20 Marks

Practical evaluation will be done by the Visiting Examiner in the presence of the teacher and will consist of the following:

A.	Physical Efficiency Tests	12 marks
B.	Specialisation Tests (The candidate is to be evaluated on **any two** basic skills of the two games/activities chosen by him/her for Continuous Evaluation)	6 marks
C.	Viva-voce (on the two games/activities chosen by the candidate)	2 marks

A. PHYSICAL EFFICIENCY TESTS

The following are the tests to evaluate the physical fitness of candidates. ***These tests are to be used for Continuous Assessment by the Teacher as well as for Practical Assessment by the Visiting Examiner.*** Tests 1 to 3 should be conducted on one day and 4 to 6 on the next.

(a) **Test 1**

50 metre run, standing start*:* Timings to be taken to the nearest tenth of a second (weather should be relatively windless without extremes of temperature).

(b) **Test 2**

Standing long jump: A flat no slip surface should be used. The candidate should stand with toes just behind the take-off line and jump when ready. After making preliminary swing with the arms the candidate swings them forward vigorously, springing with both feet simultaneously to land as far forward as possible. Distance jumped to be measured in centimetres.

(c) **Test 3**

Distance run - 1000 metres run for boys, 600 metres run for girls. Time to be taken to the nearest second.

(d) **Test 4**

(i) ***Floor push-ups for boys***: The boy takes a front-leaning position with body supported on hands and balls of feet; the arms are straight and at right angles to the body. He then dips or lowers the body so that the chest touches or nearly touches the floor, then pushes back to the starting position by straightening the arms and repeats the procedure as many times as possible. Only the chest should touch the floor; the arms must be completely extended with each push-up; the body must be held straight throughout. Scoring consists of the number of correct push-ups.

(ii) ***Push-ups for girls***: This is executed from a stall bar bench or a stool 32 cm high by 50 cm long and 35 cm wide. It should be placed on the floor about 15 cm from a wall so that the subject will not take a

position too far forward. The girl should grasp the outer edges of the bench, or stool, at the nearest corners and assume the front-leaning rest position, with the balls of her feet on the floor and with her body and arms forming a right angle. She should then lower her body so that the upper chest touches the near edge to the bench or stool, then raise it to a straight arm position as many times as possible. The girl's body should be held straight throughout. If the body sways or arches, or if the subject does not go completely down or does not push completely up, half credit is given up to 4 half credits.

(e) **Test 5**

Shuttle run: A flat course of 10 metres is required to be measured between the two parallel base lines. Behind each base line, a semicircle 50 cm radius with centre on the base line is required to be marked. In the far semicircle two wooden blocks (5x5x5 cm) are to be placed. The candidate stands with feet behind the base line, and on a signal, runs to the far line, picks up one block which the candidate places in the starting semicircle when he/she returns. The candidate then repeats the procedure with the second block. The time to the nearest tenth of a second is to be taken till the second block is grounded in the starting semicircle.

(f) **Test 6**

60-second sit-ups*:* The candidate lies with his/her back on a mat or flat surface, feet about 30 cm apart and knees flexed at a right angle. The candidate's hands with fingers interlocked are placed behind the back. A partner holds the candidate's feet in contact with the mat or floor. On the signal "Go" the candidate sits up to touch the knees with his/her elbows. Without pause he/she returns to his/her starting position and immediately sits up again. The number of sit-ups completed in 60 seconds are to be counted.

B. SPECIALISATION TESTS

Candidates are to be tested by a Visiting Examiner in the presence of the teacher in **two** of the games/activities that were selected by them for Continuous Assessment. Details of skill areas are given below.

ATHLETICS

Candidates will choose two of the following events in which they wish to be tested:

(i) Track events - sprints, middle and long distance races:

Boys - 100 m, 200 m, 400 m, 800 m, 1500 m and 3000 m.

Girls - 100 m, 200 m, 400 m, 800 m.

(ii) Track events – hurdles:

Boys - 110 m and 400 m.

Girls - 100 m.

(iii) Field events - jumps and throws:

Boys - Broad jump, high jump, triple jump, pole vault, shot-put, discus throw, javelin throw, hammer throw.

Girls - Broad jump, high jump, shot-put, discus throw.

The following fundamental skills are required:

Sprints

Practice of starts with blocks using proper command.

Time action period - Reaction time, block clearance time, acceleration time, velocity maintenance time, finish time.

Middle Distance and Long Distance Races

(i) Style of endurance running.

(ii) Methods of endurance development.

Broad Jump

(i) Approach run.

(ii) Take off.

(iii) Flying Phase.

(iv) Landing.

Hop, Step and Jump (Triple Jump)

(i) Approach run.

(ii) Take off.

(iii) Performance of hop, step and jump.

(iv) Performance of combination of hops and steps.

High Jump

(i) Approach run.

(ii) Take off.

(iii) Flying phase: scissors, straddle, western roll or "Fosbury flop".

Pole Vault (Boys only)

(i) Grip.

(ii) Pole carry.

(iii) Approach run.

(iv) Take off.

(v) Planting of pole.

(vi) Clearance of bar.

(vii) Landing.

Javelin Throw

(i) Grip.

(ii) Javelin carry.

(iii) Transition from approach to five stride rhythm.

(iv) Release.

(v) Reverse.

Shot put

(i) Stance.

(ii) Glide.

(iii) Release.

(iv) Reverse.

Discus Throw

(i) Stance.

(ii) Preliminary Swings.

(iii) Throws with one and a half turn.

(iv) Reverse.

CRICKET

1. **Batting :** pull, cut, hook, glance, stepping out to drive the flighted ball.
2. **Bowling :** outswing, inswing, off break, leg break and googly.
3. **Fielding :** Catching high and low and ground balls.

HOCKEY

1. Straight hitting and stopping:

(a) Reverse hitting and stopping

(b) Hitting on the wrong foot

2. Straight push and stopping:

(a) Reverse push and stopping

(b) Pushing on the wrong foot

3. Scooping:

(a) Push scoop

(a) Shovelling

4. Flick:

(a) Straight Flick

(b) Reverse flick

(c) Flick on the wrong foot

5. Dribbling and carrying the ball

6. Passing:

(a) Through pass

(b) Return pass

(c) Deflection pass

(d) Interchanging position

7. Dodging:

(a) Dodging to opponent's left.

(b) Dodging to opponent's right.

(c) Double dodging.

8. Different Techniques of:

(a) Corner

(b) Penalty stroke

(c) Push in

(d) Goal keeping

9. Tackling:

(a) Lunging

(b) Feinting

FOOTBALL

1. **Passing and Interpassing:**
   (a) Interpassing between two players.
   (b) Interpassing among three players.
   (c) Three men weave.
   (d) Interpassing among four players.
   (e) Related practices.
2. **Kicking:**
   (a) Revision of all kicking fundamentals.
   (b) Lofted kick with either foot.
   (c) Practice of corner kicks - lobbing chip shots and penalty kicks.
3. **Tackling:**
   (a) Interception and hasty tackles.
   (b) Sliding tackles.
   (c) Related practices.
4. **Heading:**
   (a) Related practices, front, right side and left side.
   (b) Head-up drills.
5. **Dribbling:**
   Practice of dribbling skills suited to actual playing situations.
6. **Tactics and coaching:**
   (a) Two back system - three back system.
   (b) Principles of zone and man to man defence.
   (c) Free kicks, penalty kicks, corner kicks.
   (d) Tactics of defence and attachment.

VOLLEYBALL

1. **The Pass:**
   (a) Over-head pass: Two-handed pass with back rolling.
   (b) Two-handed pass with side rolling.
   (c) Jump and pass.
   (d) Under arm pass.
   (e) Forward dive and pass.
   (f) One arm pass with side rolling.
2. **The Serve:**
   (a) Over head service (Tennis-type).
   (b) Round arm service.
   (c) Floating service (overhead and arm).
3. **The Set-up:**
   (a) Setting up for quick smash.
   (b) Move and set up (from back zones).
   (c) Setting up to different zones at varying trajectories.
4. **The Net Recovery:**
   Two-handed overhead pass without rolling, one hand under arm with or without rolling.
5. **The Attack:**
   (a) Smash with turn of body.
   (b) Smash with turn of wrist.
   (c) Round arm smash.
   (d) Smash on short pass (ascending balls).
   (e) Simple attack combination.
6. **The Block:**
   (a) Double block against different types of attack.
   (b) Double block in assigned zones.
   (c) Double block against quick attack.
   (d) Double block against attack combination.
   (e) Triple block against attack from zone.
7. **Patterns of play:**
   4-2 system, 5-1 system.

BASKETBALL

1. **Ball handling:**
   Holding position of fingers, body, position, stance of player with ball.
2. **Catching the ball:**
   (Receiving) skills involved.

3. **Passing:** Skills - (Drills in Pairs)

   (a) Two-handed chest pass.

   (b) Two-handed bounce pass.

   (c) Two-handed underhand pass (Right / Left side).

   (d) Two-handed over head pass.

4. **Dribbling:**

   Dribbling high with speed, using alternate hands, low dribble.

5. **Shooting:**

   (a) Two-handed set shot.

   (b) Two-handed free throw.

   (c) Lay up shot following dribble using right hand (over the shoulder layup).

6. **Footwork:**

   Player stance, position of feet, position of hand, elementary shuffling and slicing movements (drills).

7. **Pivoting, Stationary Pivot.**

8. **Individual defence:**

   Player stance: position of hands, position of feet, defender's position in between opponent and basket.

9. **Team defence:** Man to man defence.

10. **Team offence:** First break offence.

11. **Full Court:** Half court game using defence, offence taught.

SOFTBALL/TENNIS/BADMINTON

Candidates will be required to demonstrate competency in the rules, skills and fitness training related to the game.

SWIMMING

Candidates will be tested in *two* of the following events of their choice.

Boys: Free style – 50m, 100 m, 200 m, 400 m, 800 m.

Breast stroke – 50m, 100 m and 200 m.

Back stroke - 50m and 100m

Butterfly stroke - 50 m and 100 m

Diving - Forward dive, backward dive, reverse dive and inward dive.

Girls: Free style – 50m, 100 m, 200 m.

Breast stroke - 50 m and 100 m.

Back stroke - 50 m and 100 m

Butterfly stroke - 50 m and 100 m.

Diving - Forward dive, backward dive, reverse dive and inward dive.

DANCING

The candidates will be required to give a performance of any *two* of the following dances of their choice, with suitable accompaniment:

(i) *Indian dancing*: Bharatanatyam, Kuchipudi, Kathakali, Kathak, Manipuri, Odissi, Mohiniyattam, Bhangra and other folk dances.

(ii) *Western dancing*: Ballet, ballroom dancing, waltz, fox trot, tango, samba, charleston, square dancing; pop-dancing - jitterbug, twist, rock-and-roll.

GYMNASTICS

The candidates will be tested in four exercises using any two of the following bits of apparatus of their choice.

(i) Floor Exercise

Boys - handspring to front somersault (tucked); two headsprings; cartwheel to arabesque; arab spring; side somersault; back roll to handstand, cabriole jump throw; flic-flacs.

Girls - Leap and cabriole; step into ball of either foot; flic-flacs; round off; handspring; cat leap; legs split in air, cartwheel; handstand.

(ii) Balancing Beam (Girls only)

Run 2-3 steps; leap to riding seat with $^1/_2$ turn; rise to squat stand; ballet stand with $^1/_2$ turn; leap on either foot; step forward leap changing legs to rear leap; lunge to side; stag leap; one-arm cartwheel.

(iii) Parallel bars (Boys only)

Swing forward and cast to upper arm hand; forward roll; pirouette forward; lower to upper arm hand; swing backward; straddle forward to support (hold).

(iv) Vaulting horse

Boys - (long horse) Split vault; through vault; hand stand with cartwheel; cartwheel and handspring.

Girls - Astride vault; split vault, through vault; handspring.

(v) Horizontal bar (Boys only)

Forward and backward giant swings; change of grip; twists; the hip-circles.

YOGA

Candidates will be tested in any *four* of the following asanas:

(i) Vrikshasana (Balancing on one leg with the other flexed sidewards).

(ii) Utitha Trikonasana (Feet apart stand, side bending).

(iii) Parivrtta Trikonasana (Feet apart stand, side bend, with the trunk rotated backward).

(iv) Utitha Parvakonasana (Feet apart stand lunging on one side).

(v) Purivrita Parvakonasana (Feet apart stand lunging on one side and rotate the trunk backwards).

(vi) Virabhadrasana (Balancing on one leg with stretched hands, trunk and leg in a horizontal position).

(vii) Uthitha Hasta Padangusthasana (Balancing on one leg and trunk bending over the other stretched horizontally).

(viii) Parasuottansasen (Feet apart stand and turning one side and bend the trunk over the knee on that side.

(ix) Ushtrarsan (kneel sit and flex back the trunk).

(x) Padakastasan (Attention position, flex and trunk over the thighs).

(xi) Garudasan (Balancing one leg with the other turned over the former).

(xii) Navasana (Balancing on buttocks with the legs and trunk flexed over each other).

(xiii) Vajrasana (Sitting with flexed legs feet on the side of buttocks).

(xiv) Supta Vajrasana (Supine lying in the position of Vajrasana).

(xv) Kukutasana (Balancing on hands inserted through the thighs and legs in padmasana).

(xvi) Jannsirasana (Paschimattrawasana on one leg with the other leg flexed sideways).

(xvii) Ardha Baddha Padma Paschimttanasana (Paschimattanasana on one leg with the other in Padmasana position).

(xviii) Triang Mahaikapada Paschimatanasana (Paschimottanasana on one leg with the other in Najrasana position).

(xix) Moridriasana (Long sit with one knee flexed and kept up and trunk turned over the stretched leg).

(xx) Akanrava Dhannrasana (Long sit and pull one foot to the corresponding ear).

(xxi) Uparrshta Konasana (Long sit with feet spread and bring the head to the ground).

(xxii) Bakasana (Balancing on hands with thighs over the arms above elbows).

(xxiii) Chakrasana (Cartwheel position).

(xxiv) Nowli (contracting rectii abdominant in uddiyana position alternate relaxation and contraction of left and right muscles in quick succession).

(xxv) Kapalabathi (Quick succession of abdominal strokes in padmasana position).

(xxvi) Bhastrika (Pranavam following the strokes of Kapalabathi).

NOTE:

While testing the candidates in any two games/activities of their choice, the following method should be adopted. Test of the skill as a whole with emphasis on:

(i) Approach

(ii) Stance/Grip

(iii) Execution (degree of perfection) and

(iv) Follow through.

PERFORMANCE TABLE - PHYSICAL EDUCATION

PHYSICAL EFFICIENCY TESTS

Marks	Test No. 1 50m dash (Timing in seconds and tenths)		Test No. 2 Standing long jump (Distance in cm)		Test No. 3 Distance run (Timing in minutes and seconds)		Test No. 4 Push-ups (Numbers)		Test No. 5 Shuttle run (Timing in seconds and tenths)		Test No. 6 60 s sit-ups (Numbers)	
	Boys	Girls	Boys	Girls	Boys (1000m)	Girls (600m)	Boys	Girls	Boys	Girls	Boys	Girls
5	6.5	7.6	204	167	4 min 10 s	2 min 30 s	30	22	9.8	11.0	47	30
4	6.6	7.9	197	155	4 min 20 s	2 min 40 s	24	14	10.0	11.2	44	28
3	6.8	8.2	190	149	4 min 30s	2 min 50 s	17	8	10.2	11.6	41	26
2	7.1	8.4	183	142	4 min 40 s	3 min	10	6	10.6	11.9	37	24
1	7.5	8.9	175	132	4 min 50 s	3 min 10 s	6	3	11.1	12.1	32	20

PERFORMANCE TABLE - PHYSICAL EDUCATION SPECIALISATION TESTS

ATHLETICS - FIELD EVENTS

Marks	Long jump (m and cm)		High jump (m and cm)		Hop step & jump (m and cm)	Pole vault (m and cm)	Shot put throw (m and cm)		Discus (m and cm)	Javelin throw (m and cm)
	Boys	Girls	Boys	Girls	Boys	Boys	Boys	Girls	Boys	Boys
10	5.50	5.00	1.70	1.50	12.00	3.00	10.00	8.50	25.00	35.00
8	5.00	4.50	1.55	1.45	11.50	2.75	9.00	7.50	22.00	32.00
6	4.50	4.00	1.40	1.30	11.00	2.25	8.00	6.50	19.00	29.00
4	4.00	3.50	1.30	1.20	10.50	2.00	7.00	5.50	16.00	26.00
3	3.50	3.00	1.20	1.10	10.00	1.75	6.00	4.50	13.00	23.00
2	3.00	2.50	1.10	0.95	9.50	1.50	5.00	3.50	10.00	20.00
1	2.99	2.00	1.00	0.94	9.49	1.25	4.99	3.49	9.98	19.98

PERFORMANCE TABLE - PHYSICAL EDUCATION SPECIALISATION TESTS

ATHLETICS - TRACK EVENTS

Marks	100 m (s and tenths)		200 m (s and tenths)		400 m (s and tenths)		800 m (s and tenths)		1500 m (min and s)
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
10	11.5	13.6	24.0	25.0	56.0	68.0	2.10	2.45	4.40
8	11.8	14.4	25.1	26.1	56.1	68.1	2.15	2.50	4.45
6	12.4	15.2	26.1	27.1	58.1	71.1	2.20	2.55	4.50
4	13.2	16.0	27.1	30.1	60.1	74.1	2.30	3.05	5.00
3	14.0	16.8	28.1	33.1	62.1	77.1	2.40	3.15	5.10
2	14.8	17.6	29.1	36.1	64.1	80.1	2.50	3.25	5.20
1	15.6	18.5	30.1	39.1	66.1	83.1	3.00	3.35	5.30

PERFORMANCE TABLE - PHYSICAL EDUCATION SPECIALISATION TESTS

SWIMMING

Marks	50m free style (s and tenths)		100m free style (min and s)		200m free style (min and s)		400m free style (min and s)	50m breast-stroke (min and s)		100m breast-stroke (min and s)
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Boys	Girls	Boys
10	45.0	55.0	1:30	1:50	3.00	3.40	6.00	1.05	1.20	2:15
9	46.3	56.3	1:32.5	1:53	3.05	3.46	6.10	1.07	1.22.5	2:17.5
8	47.5	57.5	1:35	1:55	3.10	3.50	6.20	1.10	1.25	2:20
7	50.0	60.0	1:40	2:00	3.20	4.00	6.40	1.12	1.27.5	2:25
6	52.5	62.5	1:45	2:05	3.30	4.10	7.00	1.15	1.30	2:30
5	55.0	65.0	1:50	2:10	3.40	4.20	7.20	1.17	1.32.5	2:35
4	57.5	67.5	1:55	2:15	3.50	4.30	7.40	1.20	1.35	2:40
3	58.7	68.7	1:57.5	2:17.5	3.55	4.35	7.50	1.22	1.37	2:42.5
2	60.0	70.0	2:00	2:20	4.00	4.40	8.00	1.24	1.39	2:45
1	61.2	71.2	2:02.5	2:22.5	4.00.5	4.45	8.10	1.26	1.41	2:47

Note: For timings in between or higher than those indicated in the table the lower mark should be given.

PERFORMANCE TABLE - PHYSICAL EDUCATION SPECIALISATION TESTS

SWIMMING (*continued*)

Marks	50m back stroke (min and s)		100m back stroke (min and s)	50m butterfly stroke (min and s)		100m butterfly stroke (min and s)	Diving
	Boys	Girls	Boys	Boys	Girls	Boys	Description of action
10	0.55	1:10	2:00	0:55	1:05	1:50	Vertical, erect body, arms and
9	1:00	1:15	2:00.5	0:57	1:10	1:52.5	legs together
8	1:02.5	1:17.5	2:05	1:00	1:12.5	1:55	Poor angle (either backward or
7	1:05	1:20	2:10	1:02.5	1:15	2:00	forward)
6	1:07.5	1:22.5	2:15	1:05	1:17.5	2:05	Poor angle opening of arms in front,
5	1:10	1:25	2:20	1:07.5	1:20	2:10	side, etc.
4	1:12.5	1:27.5	2:25	1:10	1:22.5	2:15	Poor angle opening of arms
3	1:14	1:29	2:27.5	1:12.5	1:24	2:17.5	and legs
2	1:15	1:30.5	2:30	1:14	1:25	2:20	Poor angle opening of arms
1	1:16	1:31	2:32.5	1:16	1:26	2:25	and legs in flight.

Note: For timings in between or higher than those indicated in the table the lower mark should be given.

SAMPLE TABLE FOR PRACTICAL WORK

S. No.	Unique Identification Number (Unique ID) of the candidate	CONTINUOUS ASSESSMENT (TO BE DONE BY THE TEACHER)			PRACTICAL ASSESSMENT (TO BE DONE BY THE VISITING EXAMINER ONLY)			TOTAL MARKS Continuous Assessment + Practical Assessment (To be entered by the Visiting Examiner)
		File Work done throughout the year	Participation & performance of candidates in two games of their choice	Physical Efficiency Tests	Physical Efficiency Tests	Specialisation Tests	Viva (on any 2 games/ activities chosen)	
		4 Marks	3 Marks	3 Marks	12 Marks	6 Marks	2 Marks	30 Marks
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

Name of the Teacher:_____

Signature: _____

Date:_____

Name of the Visiting Examiner:_____

Signature: _____

Date:_____