Secondary Level Curriculum, 2078

(Grade 11-12)

(Technical and Vocational Stream)

Electrical Engineering

Government of Nepal
Ministry of Nepal
Curriculum Development Centre
Sanothimi, Bhaktapur

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Preface

Secondary Level Education in Nepal aims to produce skillful healthy citizens familiar with national customs, culture, social heritage and democratic values who can actively take part in the economic development of the country. So, the main aim of this level is to produce skilled manpower who can make special contribution to the country's all-round development, and at the same time, to produce conscious citizens with essential knowledge and skills to be ready for university education. The process of developing and revising school level curricula in Nepal is being continued in line with this objective.

In this connection, in order to bring relevant changes in secondary level curricula as per the recommendations of School Sector Development Plan (SSDP), some subjects, i. e. Plant Science, Animal Science, Computer Engineering, Electrical Engineering and Civil Engineering have been introduced under Technical and Vocational stream. According to this provision, the curricula of these subjects have been prepared, and they are being implemented. Considering the situation that the curricula of these subjects are not easily available at present, they have been published for the wider circulation. This curriculum, revised in 2078 B. S., is one of them.

Revising school level curricula is a continuous process and the role of teachers, parents and scholars is vital in making it more effective in future. Therefore, the Curriculum Development Centre always anticipates constructive suggestions from all the persons concerned.

Curriculum Development Centre
Sanothimi, Bhaktapur

Content

Curriculum Structure

Class 11-12

SN.	Class 11	Credi	Annual	Class 12	Credi	Annual
1	English	4	128	English	4	128
2	Nepali	3	96	Social Studies	3	96
3	Mathematics	3	96	Mathematics	3	96
4	Chemistry	3	96	Chemistry	3	96
5	Physics	3	96	Physics	3	96
6	Electrical Measurement and Instruments	4	128	Switch Gear and Protection	4	128
7	Electrical Installation, Estimation and Circuit Design Architecture	4	128	Renewable Energy System	4	128
8	Electrical Power System	4	128	Electrical CAD and Based Design	4	128
9	Repair and Maintenance of Electrical Equipments	4	128	Power Transmission and Distribution	4	128
	Total	32	1024		32	1024

English

Grade: 11 and 12 **Subject code: Eng. 003 (Grade 11), Eng. 004 (Grade 12)**

Credit hour: 4 **Annual working hour: 128**

1. Introduction

English is a lingua franca and is an appropriate international language for Nepal to be connected with global community. It is not only the language of international communication but also a language of higher education, mass media, information and communication technology (ICT), business, tourism, science and medicine. In the context of Nepal, English is necessary for various purposes. To be specific, our learners need English to participate in classroom interactions; to study course materials; to read things for pleasure and general information; to gain access to the world body of knowledge; to read and enjoy a wide range of literary texts, to participate in international meetings, seminars and conferences; to communicate with foreigners in general; to enhance their career development, and many more. English is taught as a compulsory subject from grade one to the bachelors level.

Ministry of Education, Science and Technology (MoEST) has approved the National Curriculum Framework (NCF), 2076 addressing the changed socio-political condition of the country and the current needs of the learners. This grade 11and 12 E nglish curriculum has been developed in line with the spirit of the new NCF. The present curriculum addresses all four language skills with prime focus on reading and writing skills. It focuses on the types of reading and writing skills that are necessary for the students in their real life. It also includes the language functions which the students need for their further studies and the world of work. A strong grammatical foundation is also given due consideration in this curriculum. This curriculum is based on the principle that learners learn language when they get sufficient opportunity to use it in appropriate contexts. Content should not be detached from the use of language. Content and language should be integrated while teaching. Therefore, the curriculum has focused not only on language and language functions, but also on a variety of fiction and non-fiction texts which provide a meaningful context for language learning. For some students, secondary education serves as a basis for preparation for the university education, whereas for some other students, it may be a preparation for entry into the world of work. This curriculum tries to address the linguistic requirements of both types of students.

This curriculum focuses on both the intensive reading of texts which is intended for language development in the learners and the extensive reading of texts which is intended for processing content and developing higher order reading and writing skills. Soft skills including critical thinking and creativity of the students have also been given due importance. For this purpose, a wide variety of texts have been included under various themes and topics. This curriculum includes level-wise competencies of students, grade-wise learning outcomes, scope and sequence of contents, learning facilitation process and evaluation process.

2. Competencies

This curriculum of Grade 11 and 12 in English language aims at developing the following competencies in the learners:

1. Use both spoken and written English for general and academic purposes in a variety of personal, social and academic contexts.
2. Read a wide variety of texts for information and understanding.
3. Read a variety of literary texts for pleasure and appreciation.

4. Read, reflect and interpret a wide range of texts.
5. Critically analyze and evaluate ideas in a wide range of level appropriate taxts.
6. Search, select and manage information from various textual and online sources.
7. Create a variety of writing for different purposes and audiences with appropriate content, style and accuracy.
8. Produce a variety of creative and critical writings.
9. Appreciate diverse cultures.
10. Listen and respond in English with accuracy and fluency
11. Communicate clearly and effectively in a range of situations using verbal and non-verbal communication strategies.

3. Grade-wise Learning Outcomes

The learning outcomes in this curriculum are distributed between grade eleven and twelve based on their levels of difficulty. However, the same learning outcomes may be introduced in grade eleven and consolidated in grade twelve. Therefore, these may go in a sequence and will be addressed in the resource materials and pedagogy.

3.1 Listening

	Learning outcomes	
Listening constructs	**Grade 11**	**Grade 12**
1. Identify and discriminate stress and intonation patterns.	▪ Identify the speaker's attitudes and feelings through their use of stress and intonation. ▪ Show an understanding of differentiating tones (warnings, advice, suggestion, etc.). ▪ Identify the effects of supra-segmental features in a connected speech.	▪ Identify the speaker's attitudes and feelings through their use of stress and intonation. ▪ Identify the speaker's purpose by distinguishing tone and intonation patterns. ▪ Identify the effects of supra-segmental features and phonological processes in a connected speech. ▪ Identify the key words and phrases in the given text. ▪ 1.5 Identify the differences between formal and informal English.
2. Listen to the spoken text and understand its gist and retrieve specific information from it.	▪ Identify the gist of a listening text. ▪ Retrieve specific information from spoken English. ▪ Compare and contrast information. ▪ Show an understanding of the functions of common discourse markers.	▪ Identify the gist, main idea and supporting details of a listening text. ▪ Retrieve specific information from spoken English, and take notes. ▪ Compare and contrast information. ▪ Distinguish between cause and effect. ▪ Interpret information and auditory cues. ▪ Show an understanding of the

		functions of a wide range of discourse markers.
3. Make inference while listening	▪ Make predictions about the subsequent content using prior knowledge, phonological clues and contextual clues. ▪ Make inference about themes and message of the spoken text from prior knowledge and contextual clues.	▪ Make predictions about the subsequent content, actions and events using prior knowledge, phonological clues and contextual clues. ▪ Make inference about purpose, intentions, themes and message of the spoken text from prior knowledge and contextual clues.
4. Listen to the spoken text and critically analyse and evaluate the information in it.	▪ Distinguish between facts and opinions in a spoken text. ▪ Draw conclusions from main ideas, specific details, prior knowledge and contextual clues. ▪ Identify the content and organisation of presentations. ▪ Form opinions about ideas presented in listening texts. ▪ Understand the meaning of common idiomatic expressions.	▪ Separate facts from opinions in a spoken text. ▪ Draw conclusions from main ideas, specific details, prior knowledge and contextual clues. ▪ Identify different points of view and make judgment. ▪ Make judgment on the relevance of spoken message. ▪ Evaluate the content and organisation of presentations. ▪ Form and interpret opinions about ideas presented in texts. ▪ Understand and interpret the meaning of common and grade appropriate idiomatic expressions.
5. Listen to the spoken text and take note of important information.	▪ Listen to a variety of audio materials (e.g. lectures, conversations, personal accounts, narratives and explanations) and take notes of them. ▪ Restate what has been heard.	▪ Listen to a variety of audio materials (e.g. lectures, conversations, personal accounts, narratives and explanations) and take notes of them. ▪ Restate what has been heard.
6. Participate actively and effectively in an interaction.	▪ Participate as an active listener in an interaction and discussion. ▪ Ask for clarification and elaboration. ▪ Respond to the speaker with appropriate facial expressions and gestures. ▪ Respect the age, gender, social position and cultural traditions of the speaker.	▪ Participate as an active listener in an interaction and discussion. ▪ Ask for clarification and elaboration. ▪ Respond to the speaker with appropriate facial expressions and gestures. ▪ Respect the age, gender, social position and cultural traditions of the speaker. ▪ Collaborate with others in order to explore and discuss understanding of spoken texts.

7. Listen to instructions, directions and announcements and follow them.	▪ Show an understanding of complex directions and instructions. ▪ Show an understanding of common public announcements e.g. at an airport, at a stadium, etc.	▪ Show an understanding of complex directions and instructions. ▪ Show an understanding of common public announcements e.g. at an airport, at a stadium, etc..
8. Gain knowledge and understanding of target culture (s) through listening.	▪ Identify nationality/ background of speaker (s) of listening texts ▪ Demonstrate an understanding of the patterns of interactions from various English speaking cultures. ▪ Show an understanding of verbal and non- verbal social conventions that characterize the English speaking culture. ▪ Compare and contrast the practices of both national and international cultures.	▪ Demonstrate an understanding of the patterns of interactions from various English speaking cultures. ▪ Analyse the verbal and non- verbal social conventions that characterize the English speaking cultures. ▪ Show an understanding of verbal and non- verbal social conventions that characterize the English speaking culture. ▪ Evaluate the practices and values of both national and international cultures.

3.2 Speaking

S.N.	Speaking constructs	Learning outcomes	
		Grade 11	**Grade 12**
1.	1. Participate effectively in interactions and conversations.	▪ Initiate, maintain and conclude an interaction using appropriate expressions. ▪ Take part in conversations on subjects of common interest. ▪ Speak fluently, accurately and effectively in different situations on a wide range of general or leisure topics. ▪ Understand and respond to what has been said by the other interlocutors in conversation. ▪ Ask questions for clarification and understanding. ▪ Respond to questions. ▪ Present ideas, opinions, experiences and arguments with confidence. ▪ Respect age, gender, social position of the listener. ▪ Indicate understanding and express certainty or uncertainty. ▪ Make proper use of extra linguistic features such as facial expressions and gestures. ▪ Use common discourse markers.	▪ Initiate, maintain and conclude an interaction using both verbal and non-verbal expressions and with confidence. ▪ Take part in relatively long conversation with multiple speakers on subjects of common interest. ▪ Speak fluently, accurately and effectively according to social norms and cultural values in different situations on a wide range of general, academic, vocational or leisure topics. ▪ Understand and respond to what has been said by the other interlocutors in conversation. ▪ Ask questions for clarification and understanding. ▪ Respond to questions in a convincing way. ▪ Respect age, gender, social position and cultural traditions of the listener. ▪ Present ideas, opinions, experiences and arguments with confidence. ▪ Use discourse markers to enable others to follow what is being said. ▪ Respond with suggestions, feedback and different viewpoints. ▪ Change the topic of an interaction as required. ▪ Indicate understanding and express certainty or uncertainty. ▪ Negotiate meaning in communication. ▪ Make proper use of extra linguistic features such as facial expressions and gestures. ▪ Use a wide range of discourse markers.

2.	Participate effectively in an informal discussion.	▪ Convey message effectively using appropriate language functions. ▪ Comment and put forward point of a view clearly. ▪ Give opinions on the topic of discussion. ▪ Comment on another person's opinions or viewpoints. ▪ Express thoughts and ideas using verbal and non-verbal communication strategies. ▪ Respect others' views and ideas.	▪ Convey message effectively using appropriate language functions and idiomatic expressions. ▪ Comment and put forward a point of view clearly and evaluate alternative proposals. ▪ Give opinions by providing relevant explanations, arguments and comments. ▪ Comment on and judge another person's views and opinions with argument. ▪ Be aware of social etiquette and apply in conversation. ▪ Respect others' views and ideas.
3.	Participate effectively in a formal discussion.	▪ Have a discussion on matters related to his/her field. ▪ Ask and reformulate questions as required. ▪ Present a point of view clearly. ▪ Present and respond to arguments. ▪ Take part in informal debates on the issues of current topics and concerns.	▪ Have a discussion on matters related to his/her field. ▪ Ask, reformulate and paraphrase questions as required. ▪ Present a point of view clearly and in a convincing way. ▪ Present and respond to arguments convincingly. ▪ Take part in both formal and informal debates on the issues of current topics and concerns. ▪ Make critical remarks or express disagreement.
4.	Give and take an interview.	▪ Actively participate in an interview both as a interviewer and as an interviewee. ▪ Expand the points being discussed. ▪ Check and confirm information. ▪ Ask questions and respond to them properly.	▪ Actively participate in an interview, including group interview both as a interviewer and as an interviewee. ▪ Expand the points being discussed in a persuasive way. ▪ Check and confirm information. ▪ Ask questions and respond to them properly.
5.	Use telecommunicatio ns effectively.	▪ Use telecommunications such as telephone, Skype and Viber effectively for personal purposes.	▪ Use telecommunications such as telephone, Skype and Viber effectively for personal and professional purposes. ▪ Maintain appropriate etiquette and ethics of telecommunications.
6.	Narrate a sequence of	▪ Narrate a sequence of events or processes using appropriate	▪ Narrate a sequence of events or processes using appropriate

	events or process	structures and vocabulary.	structures and vocabulary.
7.	Use supra-segmental features like stress, tone and intonation for expressing a range of meanings and emotions.	▪ Speak fluently and accurately with acceptable pronunciation, stress and intonation patterns. ▪ Produce utterances with appropriate features of connected speech such as assimilation and elision.	▪ Speak fluently and accurately with acceptable pronunciation, stress and intonation patterns. ▪ Produce utterances with appropriate features of connected speech such as assimilation and elision.
8.	Make effective presentations.	▪ Generate ideas and make presentations appropriate to the purpose and audience. ▪ Choose appropriate expressions and registers according to the context/field. ▪ Maintain appropriate posture and eye contact.	▪ Generate ideas and make presentations appropriate to the purpose, audience, time and style. ▪ Choose appropriate expressions and registers according to the context/field. ▪ Use appropriate discourse markers. ▪ Maintain appropriate posture and eye contact. ▪ Use effective presentation skills.
9.	Describe, people, objects, events, etc.	▪ Describe people, objects, events, etc. using appropriate structures and vocabulary.	▪ Describe people, objects, events, etc. using appropriate structures and vocabulary.
10.	Seek and provide a wide variety of information.	▪ Use a range of question forms for seeking and confirming required information. ▪ Give detailed information on different topics.	▪ Use a range of expressions for seeking, confirming, checking and elaborating required information. ▪ Give detailed information on different topics.
11.	Speak with critical analysis and evaluation.	▪ Express personal opinions to clarify the points expressed. ▪ Present reasons and examples from different sources such as reviews of books, plays and interviews to defend opinions and judgments.	▪ Express personal opinions to clarify the points expressed and persuade the interlocutors. ▪ Present reasons, examples and the details from different sources such as reviews of books, plays and interviews to defend opinions and judgments.
12.	Understand and demonstrate inter-cultural understanding.	▪ Express one's own cultural values and practices effectively and clearly. ▪ Express tolerance and respect for the cultural practices of other people.	▪ Express one's own cultural values and practices and compare it with that of others. ▪ Express tolerance and respect for the cultural practices of other people.

Note: The prescribed language functions should be included while selecting topics and tasks for speaking.

3.3 Reading

S. N.	Reading constructs	Learning outcomes	
		Grade 11	**Grade 12**
1.	Read the texts intensively for information and understanding.	▪ Scan the text and retrieve specific information from it. ▪ Skim the text and get its main idea/theme. ▪ Identify the topic sentence of a paragraph. ▪ Distinguish between cause and effect. ▪ Separate facts from opinions. ▪ Compare and contrast ideas. ▪ Find out main ideas and supporting details. ▪ Deduce the meanings of unfamiliar words and phrases in a given context. ▪ Read the texts and identify the order of events. ▪ Identify explicit as well as implicit information. ▪ Read and interpret the graphic organizers (e.g. Venn diagram, time line, semantic webs, etc.) given in the text to facilitate understanding of grade appropriate reading texts.	▪ Scan the text and retrieve specific information from it. ▪ Skim the text and get its main idea/theme. ▪ Distinguish between cause and effect and fact and opinions. ▪ Compare and contrast ideas. ▪ Identify different points of view. ▪ Find out main ideas and supporting details. ▪ Deduce the meanings of unfamiliar words and phrases in a given context. ▪ Read the text and identify the order of events. ▪ Identify explicit as well as implicit information. ▪ Read and interpret the graphic organizers (e.g. Venn diagram, time line, semantic webs, etc.) given in the text to facilitate understanding of grade appropriate reading texts. ▪ Follow the pattern of arguments with the help of the clues available in the text.
2.	Read a variety of literary texts for pleasure, appreciation and interpretation.	▪ Read and interpret literary texts (e.g. short stories, essays, poems and dramas) from a wide variety of authors, subjects and genres. ▪ Read and respond to literary works that represent a range of social, historical and cultural perspectives. ▪ Interpret multiple levels of meaning such as literal meaning, contextual meaning, figurative meaning and intended meaning in literary texts. ▪ Analyse and evaluate fiction and non-fiction including the	▪ Read and interpret literary texts (e.g. short stories, essays, poems and dramas) from a wide variety of authors, subjects and genres. ▪ Read and respond to literary works that represent a range of social, historical and cultural perspectives. ▪ Interpret multiple levels of meaning such as literal meaning, contextual meaning, figurative meaning and intended meaning in literary texts. ▪ Analyse and evaluate fiction and non-fiction including the effect of diction and figurative language. ▪ Analyse special features of languages that distinguish literary

		effect of diction and figurative language. ▪ Analyse special features of languages that distinguish literary texts from non-literary ones. ▪ Appreciate literary texts of appropriate level. ▪ Determine the themes of literary texts. ▪ Describe the characters of the literary texts.	texts from non-literary ones. ▪ Appreciate literary texts of appropriate level. ▪ Determine the themes of literary texts. ▪ Describe the characters of the literary texts.
3.	Read the texts and critically analyse, interpret and evaluate the information.	▪ Determine the writer's attitude, perspectives, purposes and intended meaning. ▪ Identify the particular kind of language used in a particular text. ▪ Analyse and synthesize information from different sources by making connections and showing relationships with other texts, ideas and subjects. ▪ Form a variety of questions at different levels about the text. ▪ Read, review and present a critical response to a text. ▪ Express opinions and make judgments about ideas, information, experiences and issues presented in literary and factual texts. ▪ Arrive at conclusion and comment on a given text. ▪ Summarise the texts.	▪ Determine the writer's attitude, perspectives, purposes and intended meaning. ▪ Identify the particular kind of language used in a particular text. ▪ Analyse and synthesize information from different sources by making connections and showing relationships with other texts, ideas and subjects. ▪ Form a variety of questions at different levels about the text. ▪ Read, review and present a critical response to a text. ▪ Express opinions and make judgments about ideas, information, experiences and issues presented in literary and factual texts. ▪ Arrive at conclusion and comment on a given text. ▪ Summarise the texts.
4.	Read the texts closely and understand the structure and organization of the text.	▪ Identify the structure and organization of paragraphs and longer texts by developing an awareness of cohesive devices. ▪ Analyse the organisational patterns of a text (such as chronological, cause-effect, problem-solution and reason-conclusion). ▪ Identify cohesive devices and	▪ Identify the structure and organization of paragraphs and longer texts by developing an awareness of cohesive devices. ▪ Analyse the organisational patterns of a text (such as chronological, cause-effect, problem-solution and reason-conclusion). ▪ Identify cohesive devices and their referents. ▪ Identify the discourse markers

		their referents. ▪ Identify the discourse markers and their functions in the texts.	and their functions in the texts. ▪ Compare the structure of different types of text organization.
5.	Read the texts and predict the content and make inference.	▪ Read the title and predict the content of the text. ▪ Make predictions about the content of a text while reading based on contextual clues, text features, background knowledge, patterns of relationship of ideas, etc. ▪ Make predictions about upcoming events in the narrative texts. ▪ Make inferences from contextual information, writer's viewpoints, implied information, etc. ▪ Use knowledge of the world or background knowledge while reading.	▪ Read the title and predict the content of the text. ▪ Make predictions about the content of a text while reading based on contextual clues, text features, background knowledge, patterns of relationship of ideas, etc. ▪ Make predictions about upcoming events in the narrative texts. ▪ Make inferences from contextual information, writer's viewpoints, implied information, etc. ▪ Use knowledge of the world or background knowledge while reading.
6.	Read the texts and take notes.	▪ Make notes by reading various resources. ▪ Read a text and make notes covering the key points.	▪ Make notes by reading various resources. ▪ Read a text and make notes covering the key points. ▪ Organise the notes and write on what has been read.
7.	Read and interpret the para-orthographic texts.	▪ Interpret and integrate information presented in diagrammatic forms (charts, graphs, tables, maps etc.) ▪ Paraphrase information or ideas of the texts.	▪ Interpret and integrate information presented in diagrammatic forms (charts, graphs, tables, maps etc.) ▪ Paraphrase information or ideas of the texts.
8.	Read texts and deduce the meaning of unfamiliar lexical items from the context.	▪ Deduce the meaning of unfamiliar lexical items on the basis of contextual, syntactic and semantic clues.	▪ Deduce the meaning of unfamiliar lexical items on the basis of contextual, syntactic and semantic clues.
9.	Use an authentic English dictionary, thesaurus, encyclopedia, and academic	▪ Use an authentic English dictionary, thesaurus, encyclopedia, and academic reference materials.	▪ Use an authentic English dictionary, thesaurus, encyclopedia, and academic reference materials.

	reference material.		
10.	Read and identify the practices and values of national and target cultures.	▪ Read and identify the practices and values of national and target cultures. ▪ Read a variety of texts from both national and international cultures for information and understanding. ▪ Read and compare social, democratic, political and economic issues in both national and international cultures. ▪ Read expository texts on issues affecting social, political, economic and cultural aspects in a given society.	▪ Read and identify the practices and values of national and target cultures. ▪ Read a variety of texts from both national and international cultures for information and understanding. ▪ Read and compare social, democratic, political and economic issues in both national and international cultures. ▪ Read expository texts on issues affecting social, political, economic and cultural aspects in a given society.

3.4 Writing

S. N.	Writing constructs	Learning outcomes	
		Grade 11	**Grade 12**
1.	Compose well-formed paragraphs.	▪ Compose well-formed paragraphs including the appropriate topic sentence, supporting details and a concluding sentence.	▪ Compose well-formed paragraphs including the appropriate topic sentence, supporting details and a concluding sentence.
2.	Write different kinds of letters and emails with appropriate format and layout.	▪ Write different types of personal letters such as letters to friends, and relatives. ▪ Write emails. ▪ Create blogs for expression.	▪ Write different types of formal letters such as letters to the editors, complain letters, job application letter, and business letters. ▪ Write emails. ▪ Prepare curriculum vitae (CV) with appropriate format and layout. ▪ Create blogs for expression.
3.	Write well organised essays on the given topics and the topics of own interest.	▪ Write well organised descriptive, narrative, argumentative and expository essays on the given topics and the topics of interest. ▪ Edit the written products.	▪ Write well organised descriptive, narrative, argumentative and expository essays on the given topics and the topics of interest. ▪ Edit the written products.
4.	Write news	▪ Write articles on current	▪ Write articles on current issues using appropriate forms and

	articles on current issues.	issues using appropriate forms and styles.	styles.
5.	Write formal reports in an appropriate style and format.	▪ Write study reports based on project works or mini-researches in an appropriate form and format.	▪ Write study reports based on project works or mini-researches in an appropriate form and format.
6.	Narrate a sequence of events and personal experiences.	▪ Narrate an event in a chronological order. ▪ Narrate a personal experience appropriately. ▪ Write stories.	▪ Narrate an event in a chronological order. ▪ Narrate a personal experience appropriately. ▪ Write biographies of famous national and international people. ▪ Write a travelogue/memoire.
7.	Describe a person or event appropriately.	▪ Describe a person or event using appropriate structures and vocabularies.	▪ Describe a person or event using appropriate structures and vocabularies.
8.	Summarise a text.	▪ Summarise a text into a short form condensing the information.	▪ Summarise a text into a short form condensing the information.
9.	Write a character sketch.	▪ Write a character sketch of the characters in a text.	▪ Write a character sketch of the characters in a text with sufficient arguments.
10.	Write a book/film review.	▪ Write a critical review of a book/film.	▪ Write a critical review of a book/film.
11.	Transfer information from tables, graphs and charts to prose and vice versa.	▪ Transfer information from tables, graphs and charts to prose and vice versa. ▪ Describe and interpret tables, charts and graphs clearly.	▪ Transfer information from tables, graphs and charts to prose and vice versa. ▪ Describe and interpret tables, charts and graphs clearly.
12.	Prepare communiqué and press release.	▪ Prepare communiqué in a simple and clear form.	▪ Prepare a press release of an organisation.
13.	Use the mechanics of writing properly.	▪ Write a variety of text types using spelling, punctuation, capitalisation, contractions, abbreviations, acronyms, numbers and numerals properly.	▪ Write a variety of text types using spelling, punctuation, capitalisation, contractions, abbreviations, acronyms, numbers and numerals properly.
14.	Use various strategies for generating and organising ideas	▪ Use writing strategies such as brainstorming, making mind maps and spider grams for generating ideas.	▪ Use writing strategies such as brainstorming, making mind maps and spider grams for generating ideas. ▪ Gather required information for

	for writing.	▪ Gather required information for writing from various printed and online sources. ▪ Draft interview questions to collect information. ▪ Take notes while reading or interviewing and use the notes for writing. ▪ Use a range of organisational strategies such as clustering, webbing, and mapping to present information. ▪ Critically analyse the sample writings to find out their structure and styles.	writing from various printed and online sources. ▪ Draft interview questions to collect information. ▪ Take notes while reading or interviewing and use the notes for writing. ▪ Use a range of organisational strategies such as clustering, webbing, and mapping to present information. ▪ Critically analyse the sample writings to find out their structure and styles.
15.	Apply process approach to writing for producing a variety of creative writings.	▪ Apply the stages of process approach (i.e. planning, making an outline, preparing the first draft and revising, editing and producing the final draft) for creating a variety of creative writings such as essays, personal experiences and articles.	▪ Apply the stages of process approach (i.e. planning, making an outline, preparing the first draft and revising, editing and producing the final draft) to create a variety of creative writings such as essays, personal experiences and articles.
16.	Use an authentic English dictionary, thesaurus, encyclopedia, and academic reference material.	▪ Use an authentic English dictionary, thesaurus, encyclopedia, and academic reference materials for drafting, revising and editing their writing. ▪ Develop personal dictionary.	▪ Use an authentic English dictionary, thesaurus, encyclopedia, and academic reference materials for drafting, revising and editing their writing. ▪ Develop personal dictionary.

Note:

Self-exploration and self-expression/creative writing should be dealt with as an inherent part while interacting with texts.

4. **Scope and Sequence**

4.1 Reading

The content of reading section is divided into two parts: Part I and Part II. Part I includes a wide variety of contemporary issue-based thematic texts intended for the practice of (a) intensive reading (b) grammar (c) vocabulary (d) listening and speaking (e) writing. Part II is built on the successful exposition of Part I. Part II includes literary genre-based selected texts of different types for reading for pleasure, for both intensive and extensive purposes so as to enable the learners to discern different aspects of literary texts and practise creative writings, which involves expression of imagination.

Part I (Outlines for the selection of texts)

There will be a wide variety of texts on different issues- both local and global of mainly contemporary concerns, which include gender issues, diaspora, science and technology, depletion of natural resources, etc. There will be maximum 21 reading texts of moderate length not exceeding 2000 words and technical

terms at each grade. The texts should be taken from various thematic areas that have been proposed below. Around each selected text, specially tailored exercises will be developed for supporting the learners' engagement with the texts.

S. No.	Thematic areas	Possible topics
1.	Education and humanity	ethics, human values, moral values, education, spirituality, animal rights, patriotism, responsibility of citizens
2.	Health, sports and adventure	yoga, travelogue, illness, disease, diet, nutrition, epidemics, hygiene, mental health, physical exercise, traditional and alternative medicine, meditation
3.	Media and society	change in communication and pace of life, advertising, bias in media, the Internet, radio and television, telephone, press
4.	History and culture	identity, language, ethnicity, ethnic groups in Nepal, folk literature, folk songs, folk culture/children's literature diaspora, ethics, cultural diversity, beliefs, values and norms, etiquette, historical events, national customs
5.	Ecology and development	global warming, deforestation, diversity, sustainable development, population, agronomy, forestry, wildlife, weather, ecosystem, food and water, the effect of man on nature, the environment, natural disaster
6.	Science and technology	ethics and science, impact of ICT on society, entertainment, renewable energy
7.	Globalisation and economy	international economy, migration, poverty and famine, global citizenship
8.	Humour and satire	humour, satire
9.	Democracy and human rights	democracy, human rights, gender, law and justice, legal awareness, children's rights, women's rights, rights of senior citizens, non-violence, charity
10.	Home life, family and social relationships	celebrations and social events, friendship, work, family, social acceptance, sex education
11.	Arts, music and creation	painting, arts, music, creation
12.	Fantasy	fantasy, imagination
13.	Career and entrepreneurship	jobs, career, entrepreneurship, problems of unemployment
14.	Power and politics	power, politics, struggle, conflict
15.	War and peace	war, peace

16.	Critical thinking	critical thinking, divergent thinking, logical thinking

Possible text types for part I

A wide variety of texts will be covered for reading purposes. Reading texts for part I will cover the following types:

- interviews
- book/film reviews
- news reports and articles
- literary writings
- reports
- academic publications
- letters
- essays
- news articles
- biographies/auto-biographies
- product guides
- poems
- blogs
- brochures
- emails
- travelogues/memoire

Part II (Outline for the selection of reading texts)

As mentioned before, this part will consist of different types of creative works that involve the expression of imagination and art so that the students can perceive how language functions differently. These are higher functions. This section will expose the students to a different world of imagination and art. This will encourage them to read more, think more and express with individual artistry. There lies infinite possibility of growing independently. In this part, there will be maximum **20** reading texts of moderate length at each grade.

The genres that will be included in this part along with the number of texts of each genre is given below:

S. N.	Genres	Number of texts to be included
1.	Short stories	7
2.	Poems	5
3.	Essays	5
4.	One act plays	3
Total		20

Based on the above genres, different types of reading and writing tasks should be developed so that the students can think more independently, work creatively and develop a good foundation for the university level education.

The tasks incorporated in this part will focus on:

- glossary
- literary devices used in the texts
- comprehension questions (short and long: literature-based reading, reading between the lines, appreciation of texts, interpretation of texts)
- writing a summary
- describing the character
- comparing and contrasting
- critical and creative writing

4.2 Writing

Grade 11	Grade 12
1. Paragraphs 2. Personal letters (letters to friends and relatives) emails, blogs 3. Essays (descriptive, narrative, argumentative and expository) 4. News articles 5. Formal reports based on project works or mini-research 6. Narratives (personal experiences, stories, events, travelogues, memoire) 7. Descriptions (persons, events) 8. Summaries 9. Character sketch 10. Book/film review 11. Transferring information from para-orthographic texts 12. Communique 13. Mechanics of writing 14. Writing strategies 15. Process approach to writing	1. Paragraphs 2. Formal letters (letters to the editors, job application, business letters) 3. Curriculum vitae 4. Essays (descriptive, narrative, argumentative and expository) 5. News articles 6. Formal reports based on project works or mini-research 7. Narratives (personal experiences, stories, events, travelogues, memoire) 8. Descriptions (persons, events) 9. Summaries 10. Character sketch 11. Book/film review 12. Transferring information from para-orthographic texts 13. Press release 14. Mechanics of writing 15. Writing strategies 16. Process approach to writing

4.3 Listening and speaking

As far as possible listening and speaking skills will be practised not in isolation but in the context of reading texts in an integrated way. Listening texts will cover the following types in both grades:

- Lectures
- Talks
- Presentations
- Conversations
- Personal accounts (e.g. oral anecdotes, past experiences, etc.)
- Interviews
- Short discussions
- Narratives (e.g. radio dramas)
- Procedures (e.g. instructions and directions)
- Factual accounts (news reports, eye witness accounts)
- Explanations (e.g. how an engine works)
- Expositions (debates, speech, advertisements)
- Public announcements

- Weather forecast

Speaking skill will be linked with the prescribed language functions. The prescribed language functions will be included in the tasks and topics for speaking. Speaking tasks and topics should be linked directly to the reading texts. Speaking tasks will cover the following main areas in both grades:

- conversations/interactions
- formal and informal discussions
- interviews
- telecommunications
- narrating
- making presentations
- describing

4.4. Language functions

The language functions prescribed in this curriculum should be the basis developing tasks for listening and speaking, and the grammar should be linked to the language functions.

Grade 11	**Grade 12**
1. Expressing good wishes 1. Giving directions and instructions 2. Expressing agreement/disagreement 3. Expressing decisions, intentions and plans 4. Expressing obligation 5. Requesting and offering 6. Suggesting and advising 7. Describing objects, people and places 8. Asking about opinions/giving opinions 9. Describing experiences 10. Describing hopes, wants and wishes 11. Expressing certainty, probability, doubt 12. Interrupting 13. Generalizing and qualifying 14. Expressing reactions, e.g. indifference 15. Talking about regular actions and activities 16. Encouraging/discouraging 17. Persuading 18. Comparing past and present 19. Narrating past events, actions and experiences 20. Expressing complements 21. Reporting	1. Expressing feelings, emotions and attitudes 2. Expressing certainty 3. Expressing indifference 4. Making comparisons and contrasts 5. Arguing/defending a point 6. Responding to counter arguments 7. Expressing disappointment 8. Clarifying 9. Describing processes 10. Predicting 11. Expressing degrees of certainty 12. Expressing necessity 13. Speculating 14. Giving reasons 15. Denying 16. Complaining/criticizing 17. Reminding 18. Summarizing 19. Narrating past events, actions and experiences 20. Reporting 21. Announcing

4. 5. Grammar

The grammar part of the curriculum will include the following topics:

a. Adjectives and adverbs
b. Concord/subject verb agreement
c. Prepositions

d. Modal auxiliaries
e. Tense and aspects
f. Infinitives and gerunds
g. Conjunctions,
h. Relative clause
i. Voice
j. Reported speech

The grammar should not be taught separately. It should be dealt with in the texts as far as possible.

4.6. Sounds, vocabulary and dictionary use

a. Sound system of English
   - Consonants
   - Vowels
b. Vocabulary study-word formation
   - Stem/root - Suffixes
   - Prefixes - Derivation
   - Inflexion - Synonyms/antonyms
   - Parts of speech - Idioms and phrases
   - Nouns-number - Verb conjugation
   - Spelling - Punctuation
c. Dictionary use (focus on the use of electronic dictionary)
d. Idioms and phrasal verbs

The Curriculum has two broad sections : Language Development and literature. The allocation of working hours for language development and literature will be 73 and 55 respectively.

Note: Activities focusing on the specific features of vocabulary e.g. prefixes, suffixes, changing word class, synonyms, antonyms, giving single words, concussing words, etc. should be designed based on the reading texts.

5 Learning Facilitation Process

5.1 Principles of Language Pedagogy

The current grade XI and XII curriculum is based on the following pedagogic principles :

- ***Content and language integrated learning:*** Language learning becomes effective when the learners develop an awareness of some specific content knowledge. Meaningful content relating to the real world helps learners comprehend not only the content itself but also the accompanying language. Integrating content and language is a clear departure from the mere communication towards a meaningful cognition through the language being learnt.
- ***Real world link:*** The principle of real world link is about exposing learners to the realities of the world through meaningful information and knowledge. Simulated and real tasks allow learners to envisage how the English language will be used in their real life.
- ***Diversity as a resource:*** In diverse classrooms, with learners from multilingual and multi-cultural backgrounds, exploiting diversity as a resource helps not only in the teaching learning process but also in creating social cohesion. The content from diverse contexts establishes the pluralistic concept first in the classrooms and later in the real world.
- ***Learning through Information and Communication Technology (ICT):*** With the advent of the ICT, language learning has been more accessible to the learners. The mobile and media technologies

allow learners to access learning materials from anywhere and anytime. The use of ICT tools in the classroom pedagogy gives learners more autonomy in different ways.

- ***Learner engagement:*** Language learning becomes enriching as well as fulfilling when learners are fully engaged. Their engagement in the pedagogical process should be ensured with their involvement in the meaningful tasks, projects and out of class activities. Engaged learners are not only successful in developing their language but also become a resource for the class.

5.2 Learning Activities

Based on the above-mentioned pedagogical principles, the following activities have been suggested in order to achieve the competencies of this curriculum:

- Reading and presentation
- Writing projects
- Dramatization, role-play and simulation
- Inquiry-based writing
- Reading for comprehension
- Reading for critical assessment/analysis
- Discussion sessions
- Think - Pair- Share
- RDWS (Read, Discuss, Write and Say/Share)
- Teacher-guided self-study
- Journal writing
- Library visits
- Listening to lyrical poems and songs
- Reciting lyrical poems and songs
- Watching movies (animated/unanimated, comic) and dramas
- Brainstorming and mind mapping
- Quick write/flash writing
- Book/film reviews
- Paraphrasing

5.3 Instructional Materials for Learning Facilitation

Each student must have a textbook. Each teacher should have a teacher's guide and a set of teacher support materials for the appropriate grade, including digital and electronic materials as far as practicable. Teachers should make an extensive and proper use of the board. To make learning easy, effective and interesting, a variety of materials should be used including the following:

- Charts
- Comparison tables
- Role cards
- Newspapers
- Bulletins, brochures
- Pictures/drawings
- Audio-visual materials
- Writing samples (e.g. essay, book/film review, mind mapping, brainstorming, etc.)
- Worksheets
- Flash cards
- Formats (of book review/film review/project work, etc.)
- Dictionaries, computers, audio players and mobile phones

- Multi-media
- Online resources
- Readers
- Additional references
- Sample interpretation/sample summaries/character sketches/poems, etc.

6. Student Assessment

The letter grading system will be used for assessing the students' performance. In order to assess the student's learning achievement as expected by this curriculum, formative as well as summative and internal as well as external assessment will be done.

In order to ensure the learning of the students, informal assessment will be conducted regularly and timely feedback will be provided to the students for improvement. The goal of formative assessment is to help the learners to learn more rather than to check what they have learnt and what they have not. Formative assessment should focus on those areas which pose problems in learning. This can also take the form of remedial teaching. Formative assessment should focus on the development of all the language skills and aspects in the learners. Various classroom activities and techniques should be used to help the learners to learn more. The following techniques/activities can be used as tools for formative assessment:

• Observation of students' linguistic behaviour • Anecdotal record • Rating scale • Check lists • Work sample/written samples • Interviews • Home assignments	• Portfolio • Tests (class, weekly, monthly, trimister) • Project works • Creative works • Self-initiation in learning • Class work	• Games • Debates • Story telling/retelling • Poetry recitation • Dramatization/simulation • Role play • Group discussion • Journal writing

As a part of summative assessment, tests for assessing four skills of language, viz. listening, speaking, reading and writing will be conducted terminally. Listening and speaking tests will be conducted on practical basis. There will be both internal as well as external evaluation as part of summative or final assessment.

6.1 Internal Evaluation: The international evaluation convers 25 marks. The allocation of marks is as follows:

S. N.	Areas	Marks
1.	Participation	3
2	Listening test	6
3	Speaking test	10
4	Score from terminal exams	6
	Total marks	**25**

6.2 External evaluation: The external evaluation carries 75 marks. The allocation of marks for each language skill and aspect is given below:

S. N.	Language skills and aspects	Marks
1.	Reading	35
2.	Writing	25
3.	Grammar	10
4.	Vocabulary	5
	Total marks	**75**

6.3 Alternative Evaluation

For the students with disabilities, alternative assessment tools will be used. They are suggested in the test specification grid.

6.4 Elaboration of Internal Assessment

S. N.	Areas	Marks	Guidelines for evaluation
1.	Participation	3	This covers students' attendance, participation in classroom activities and their performance on classwork, homework and project works assigned to them. The teacher needs to maintain the record of students. The same record is to be consulted to award the marks for this aspect.
2	Listening test	6	**1. Listening comprehension** **Types of sound files:** (The sound files may contain: lectures, talks, presentations, poetry, interviews, conversations, short discussions, advertisements, personal accounts (oral anecdotes, past experiences) narratives (e.g. radio dramas), instructions and directions, factual accounts (e.g. eye news reports, eye witness accounts) explanations, public announcements operating instructions, weather forecast) There will be two listening tasks on two different sound files. Each task should consist of three questions. *Note: The sound files should be authentic and clearly articulated with normal speed of delivery. Each sound file should be of 3 minute maximum in length.* **Listening constructs to be focused:** a. **Specific information** b. **Gist** c. **Main information and supporting details** d. **Specific information and important details** **Number of sound files**: Two sound files each carrying 3 marks will be used.

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Length of the sound file: Maximum three minutes
Types of test items
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<td>1. Multiple choice
2. Fill in the blanks
3. Matching</td>
<td>4. Short answer questions</td>
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Alternative test methods for students with speech and hearing difficulties
For the students with speech and hearing difficulties, any one of the following types of questions can be asked:
1. Paragraph writing on a given topic
2. Writing a letter
3. Writing a description of the given picture
Time: 20 minutes.
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<tr>
<td>3</td>
<td>Speaking</td>
<td>10</td>
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The speaking test will be administered practically. The test starts with greeting and introducing to make the students feel comfortable. This will not carry any marks. The speaking test consists of the following sections:
1. Introduction and interview (3 marks)
The students will be asked at least any three questions on their personal affairs and immediate situation. (How are you preparing for the exam? What will you study after grade 12? What’s your aim in life? Do you like English? Why?/Why not?
2. Describing pictures (4 marks)
The students are given a picture or a set of pictures. They are expected to describe the picture in at least 8 sentences.
3. Speaking on a given topic (3marks)
The students will be given a topic like; my school, my hobby, my family. They will get one-minute time to think over the topic and then they will speak on the topic. This will also be done individually.
Time: 10 to 15 minutes for per student
Alternative test methods for students with visual difficulties
For the students with visual difficulties, ask them to narrate a sequence of events instead of the task 2 ‘describing pictures’ above.
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<tr>
<td>4</td>
<td>Score from terminal exams</td>
<td>6</td>
<td>3 marks from each terminal exams</td>
</tr>
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नेपाली

कक्षा : ११ र १२ **विषय सङ्केत :** Nep. 001 (कक्षा ११), Nep. 002 (कक्षा १२)

पाठ्यघण्टा : ३ **वार्षिक कार्यघण्टा : ९६**

१. परिचय

नेपाल बहुजातीय, बहुसांस्कृतिक एवम् बहुभाषिक मुलुक हो । बहुजातीय र बहुसांस्कृतिक विशेषता भएको राष्ट्रमा राष्ट्रिय एकता प्रवर्धन गर्न तथा सामाजिक, सांस्कृतिक सम्बन्ध र समन्वय कायम गर्न सम्पर्क भाषाको आवश्यकता पर्दछ । यसका लागि विद्यार्थीमा भाषिक सक्षमताको विकास हुनुपर्दछ । विद्यार्थीमा भाषिक सञ्चार एवम् बोध र अभिव्यक्तिगत सिपको विकास हुनु नै भाषिक सक्षमता हो । नेपाली भाषा विद्यालय तहको शिक्षणको प्रमुख माध्यम, सरकारी कामकाज र नेपाली समाजको साझा सम्पर्कको भाषा हो । पहिलो, दोस्रो एवम् विदेशी भाषाका रूपमा नेपाली भाषाको प्रयोग हुँदै आएको छ । यस दृष्टिले नेपाली भाषाको प्रयोगमा व्यापकता रहेको छ । नेपालमा नेपाली भाषा सामाजिकीकरण, अन्तरभाषिक व्यवहार, सञ्चार, प्रशासन, प्रविधि र मौखिक तथा लिखित व्यवहारको प्रमुख माध्यमका रूपमा रहिआएको छ । नेपाली समाजको बहुलतालाई दृष्टिगत गर्दै सबै प्रकारका ज्ञान र सिप प्राप्त गर्न तथा विभिन्न माध्यमबाट अन्तर्राष्ट्रिय स्तरका ज्ञानसमेत नेपाली भाषामा सिक्न सक्ने बनाउन विद्यालय तहमा नेपाली भाषाको शिक्षण अपरिहार्य छ । त्यसैले विद्यालय तहमा नेपाली भाषालाई अनिवार्य विषयका रूपमा शिक्षण गर्नुपरेको हो । नेपाली भाषा शिक्षणको मुख्य उद्देश्य विद्यार्थीमा नेपाली भाषासम्बद्ध भाषिक सिप एवम् व्यावहारिक र सिर्जनात्मक क्षमताको विकास गराउनु हो ।

प्रस्तुत पाठ्यक्रमको उद्देश्य विद्यार्थीमा भाषिक सक्षमता अभिवृद्धि गराउनु हो । (कक्षा ९-१०) पूरा गरेका विद्यार्थीको स्तरलाई ध्यान दिई विद्यालय तहको समाप्तिपछि अन्य क्षेत्रमा लाग्ने तथा उच्च शिक्षामा प्रवेश गर्नेहरूको आधारभूमिका रूपमा नेपाली भाषामा सक्षम बनाउने अभिप्रायले यो पाठ्यक्रम तयार पारिएको हो । माध्यमिक तह (कक्षा ११-१२) पूरा गर्दा विद्यार्थीहरूले नेपाली विषयमा प्राप्त गर्ने तहगत सक्षमता र कक्षागत सिकाइ उपलब्धिलाई यस पाठ्यक्रममा समावेश गरिएको छ । पाठ्यक्रममा विद्यार्थीमा बोध एवम् अभिव्यक्तिगत क्षमताको विकासका लागि उपयुक्त विधा र क्षेत्र निर्देश गरिएको छ । यसमा प्रयोजनपरक भाषिक सिप विकास र कार्यमूलक व्याकरणमा विशेष ध्यान दिइएको छ । तदनुरूपका सिकाइ सहजीकरण प्रक्रिया र मूल्याङ्कन विधि पनि समेटिएका छन् । यस पाठ्यक्रममा निम्नलिखित पक्षहरूलाई प्राथमिकतामा राखिएको छ :

- समयसापेक्ष जीवनोपयोगी एवम् सक्षमतामा आधारित भाषिक सिप
- पाठगत विविधताको प्रस्तुति र कार्यमूलक व्याकरण
- स्तरअनुरूपका पाठ्यवस्तुको छनोट एवम् स्तरण
- विद्यार्थीकेन्द्रित सिकाइमा आधारित सहजीकरण प्रक्रिया
- प्रयोजनपरक भाषिक सिप र सिकाइमा जोड
- खोजपरक, परियोजनामूलक तथा सिर्जनात्मक भाषिक अभ्यासमा जोड
- भाषिक सामर्थ्य र सम्पादनका रूपमा भाषिक सिपको विकासमा जोड
- व्याकरणलाई भाषा प्रयोगको आधारका रूपमा सैद्धान्तिकभन्दा रचनात्मक बनाउने प्रयत्न
- स्वतन्त्र पठन र रचना कौशलको विकासमा जोड
- सिपगत सक्षमता परीक्षणमा आधारित भाषिक मूल्याङ्कन

२. तहगत सक्षमता

यस तहका अन्त्यमा विद्यार्थीहरू निम्नलिखित सक्षमता प्राप्त गर्न समर्थ हुने छन् :

१. विविध विषयक्षेत्रका मौखिक सामग्रीको बोध र अभिव्यक्ति

२. विविध विषयक्षेत्रका लिखित सामग्रीको सुरुचिपूर्ण पठन र बोध

३. पाठगत सन्दर्भको अनुमान, घटना, चरित्र र परिवेशको पहिचान, बोध र प्रस्तुति

४. देखेसुनेका, पढेका र अनुभव गरेका विषयवस्तुको मौखिक र लिखित अभिव्यक्ति

५. सामाजिक, सांस्कृतिक, राष्ट्रिय एवम् मानवीय मूल्यअनुकूलको लेख्य अभिव्यक्ति

६. दैनिक व्यावहारिक लेखनमा दक्षता प्रदर्शन

७. सिर्जनात्मक र प्रतिक्रियापरक अभिव्यक्ति कौशल

८. अन्तरसांस्कृतिक एवम् भाषिक मूल्यप्रतिको सचेतता र सम्मानजनक भाषिक व्यवहार

९. तार्किक, अन्तरक्रियात्मक एवम् समस्या समाधानमूलक अभिव्यक्ति कौशल

१०. खोज तथा परियोजनामा आधारित लेख र रचनाको सिर्जना

११. समालोचनात्मक चिन्तनसहितको मौखिक र लिखित अभिव्यक्ति

३.कक्षागत सिकाइ उपलब्धि

	कक्षा : एघार	**कक्षा : बाह्र**
१. सुनाइ र बोलाइ सिप	१. उच्चरित हुने वर्णहरूको पहिचान गरी शुद्ध उच्चारण गर्न २. विविध पाठ, सञ्चार माध्यम र अन्य सामग्री सुनेर तार्किक प्रतिक्रिया व्यक्त गर्न ३. दिइएका विषय वा शीर्षकमा समूहगत छलफल एवम् प्रस्तुतीकरण गर्न ४. सन्दर्भअनुसार गति, यति र लय मिलाई मौखिक अभिव्यक्ति गर्न ५. देखेसुनेका, पढेका तथा अनुभव गरेका विषयलाई सिलसिला मिलाई प्रस्तुत गर्न ६. सामाजिक, सांस्कृतिक सन्दर्भ, वक्ताको अवस्था तथा संवेगका आधारमा प्रतिक्रिया दिन	१. शब्द सुनी अक्षरीकरणसहित शुद्ध उच्चारण गर्न २. विविध पाठ, सञ्चार माध्यम र अन्य क्षेत्रका अभिव्यक्ति सुनेर विश्लेषणात्मक प्रतिक्रिया व्यक्त गर्न ३. दिइएका विषय वा शीर्षकमा समूहगत छलफल एवम् प्रस्तुतीकरण गर्न ४. सन्दर्भअनुसार गति, यति र लय मिलाई मौखिक प्रतिक्रिया व्यक्त गर्न ५. देखेसुनेका तथा अनुभव गरेका विषयलाई सिलसिला मिलाई प्रस्तुत गर्न ६. सामाजिक सन्दर्भ, प्रसङ्ग, वक्ताको अवस्था, अभिवृद्धि र संवेग तथा भाषाको प्रयोजनपरक भेदका आधारमा शिष्टतापूर्वक प्रतिक्रिया व्यक्त गर्न ७. औपचारिक कार्यक्रममा सहभागी भई आफ्ना विचार प्रभावकारी रूपमा व्यक्त गर्न
२. पढाइ सिप	१. लिखित सामग्रीलाई गति, यति, लय मिलाई शुद्धसँग पढ्न २. साहित्यिक तथा प्रयोजनपरक पाठहरू पढी पारिभाषिक/प्राविधिक शब्दलाई वाक्यमा प्रयोग गर्न ३. पाठमा प्रयोग भएका शब्दको हिज्जे र अर्थबोधका	१. लिखित सामग्रीलाई गति, यति, लय मिलाई शुद्धसँग पढ्न २. साहित्यिक तथा प्रयोजनपरक पाठहरू पढी पारिभाषिक/प्राविधिक शब्दको सन्दर्भअनुसार वाक्यमा प्रयोग गर्न

	लागि शब्दकोशको प्रयोग गर्न ४. लिखित सामग्रीको सस्वर तथा मौन पठनद्वारा पढाइको गति विकास गर्न ५. लिखित सामग्रीका आधारमा सन्दर्भको अनुमान, घटना, चरित्र र परिवेशको बोध गरी पढ्न ६. विभिन्न पाठ तथा तिनका विशिष्ट अंशको व्याख्या एवम् समीक्षा गर्न सक्ने गरी पढ्न ७. विविध क्षेत्रसँग सम्बन्धित पाठहरू पढी बोध गर्न ८. पूर्वानुमान, निष्कर्ष, सारांश, संश्लेषण, प्रतिक्रिया व्यक्त गर्न सक्ने गरी पाठहरू पढ्न	३. पाठमा प्रयोग भएका शब्दको हिज्जे, उच्चारण, स्रोत, शब्दवर्ग, बनोट र अर्थ पहिचानका लागि शब्दकोशको प्रयोग गर्न ४. लिखित सामग्रीको द्रुतपठन गर्न ५. लिखित सामग्री भाव विश्लेषण गर्न सक्ने गरी पढ्न ६. विभिन्न पाठ तथा तिनका विशिष्ट अंशको व्याख्या एवम् समीक्षा गर्न सक्ने गरी पढ्न ७. विविध क्षेत्रसँग सम्बन्धित पाठहरू पढी बोध गर्न ८. पूर्वानुमान, निष्कर्ष, सारांश, संश्लेषण, विश्लेषण, गरी प्रतिक्रिया व्यक्त गर्न सक्ने गरी पाठहरू पढ्न
३. लेखाइ सिप	१. नेपाली वर्णको पहिचान र वर्गीकरण गरी लेख्न २. वर्णविन्यास र लेख्य चिह्नहरूको शुद्ध प्रयोग गर्न ३. मौखिक एवम् लिखित अभिव्यक्तिको बुँदाटिपोट गर्न र सारांश लेख्न ४. व्यावहारिक लेखन (घरायसी पत्र, निमन्त्रणा, बधाई, शुभकामना, सम्मानपत्र, सूचना, विज्ञापन, श्रद्धाञ्जली, समवेदना) गर्न ५. देखेसुनेका, पढेका र अनुभव गरेका विषयवस्तुका बारेमा सिलसिला मिलाएर लिखित वर्णन गर्न ६. कुनै पनि विषय शीर्षकमा अर्थपूर्ण, क्रमबद्ध तथा प्रभावकारी रूपमा अनुच्छेद रचना गर्न ७. पाठको प्रकृतिअनुसार विषयक्षेत्र, संरचना (आदि, मध्य र अन्त्यको शृङ्खला), घटना, चरित्र, परिवेश, भाव, लयबोध गरी लेख्न ८. साहित्यिक विधा र पाठहरूको विश्लेषण गर्न र विशिष्ट अंशको व्याख्या गर्न ९. लिखित अभिव्यक्तिका क्रममा व्याकरणका आधारभूत नियम पालना गरी लेख्न १०. विभिन्न विधामा आधारित भई निर्देशित र स्वतन्त्र सिर्जना गर्न ११. कोशीय प्रविष्टिअनुसार शब्दक्रम मिलाई लेख्न	१. शब्दमा रहेका अक्षर संरचना छुट्याई लेख्न २. वर्णविन्यास र लेख्य चिह्नहरूको शुद्ध प्रयोग गर्न ३. विज्ञान, प्रविधि, सामाजिक शास्त्र, वाणिज्य कानुन आदि क्षेत्रसँग सम्बन्धित प्रयोजनपरक लेखन गर्न ४. व्यावहारिक लेखन गर्न (व्यावसायिक पत्र, भरपाई, तमसुक, करारनामा, मन्जुरीनामा, मुचुल्का, प्रशासनिक टिप्पणी तथा बैठक निर्णय, विज्ञप्ति, बोलपत्र र सम्पादकलाई चिठी लेखन) ५. सामाजिक, सांस्कृतिक, राष्ट्रिय एवम् मानवीय मूल्यमा आधारित भई लिखित अभिव्यक्ति दिन ६. देखेसुनेका, पढेका र अनुभव गरेका विषयवस्तुका बारेमा सिलसिला मिलाएर लिखित वर्णन गर्न ७. पाठको प्रकृतिअनुसार सन्दर्भको अनुमान, संरचना पहिचान, घटना वर्णन, भावबोध, तार्किक विश्लेषण गरी लेख्न ८. साहित्यिक विधा र पाठहरूको विश्लेषण गर्न र विशिष्ट अंशको व्याख्या गर्न ९. लिखित अभिव्यक्तिका क्रममा व्याकरणका आधारभूत नियम पालना गरी लेख्न १०. विभिन्न विधामा आधारित भई निर्देशित र स्वतन्त्र सिर्जना गर्न ११. विद्युतीय सञ्चार माध्यममा प्रकाशित सामग्री तथा पुस्तक र लेख रचना पढी प्रतिबिम्बात्मक लेखन गर्न १२. कोशीय प्रविष्टिअनुसार शब्दक्रम मिलाई लेख्न

४. विषयवस्तुको क्षेत्र र क्रम

(क) कक्षा : ११

क्र सं	विधा/ पाठ	क्षेत्र	बोध	अभिव्यक्ति	भाषातत्त्व	पाठ्यघण्टा
१.	कविता (पद्य)	देशभक्ति	• कविताको संरचना • विषयको क्रम, भाषा, लय आदिको बोध • देशभक्ति, संस्कृति र भाषासम्बन्धी पद्यांशको बोध	• कविताको लयबद्ध वाचन • कवितालाई गद्यमा रूपान्तरण • कविता सिर्जना (अनुकरणात्मक लेखन)	(अ) नेपाली कथ्य र लेख्य वर्ण (स्वर र व्यञ्जन) को पहिचान (आ) उच्चार्य व्यञ्जन वर्णको पहिचान र प्रयोग (स्थान, प्रयत्न, घोषत्व र प्राणत्व)	७
२.	कथा	सामाजिक	• कथाको संरचना (विषय, अनुच्छेद योजना, घटनाक्रम, संवाद, भाषा आदि) को बोध	• कथाका घटनाहरूको टिपोट • कथाका पात्रहरूको चरित्र वर्णन • लघुकथा लेखन (अनुकरणात्मक)	(अ) मूल र व्युत्पन्न शब्दको पहिचान (आ) शब्द स्रोत : तत्सम, तद्भव र आगन्तुक शब्द (इ) शब्दकोशीय प्रयोग	८
३.	निबन्ध	सांस्कृतिक (आत्मपरक)	• निबन्धको संरचना (अनुच्छेद योजना, विषय प्रस्तुतिको क्रम, भाषाशैली आदि) को बोध • निबन्धमा प्रयुक्त कठिन शब्दको अर्थबोध	• निबन्धमा वर्णित मुख्य विषयको बुँदाटिपोट र सार लेखन • स्थानीय समाजमा प्रचलित चाडपर्वको वर्णन गरी निबन्ध लेखन • तार्किक, अन्तरक्रियात्मक एवम् समस्या समाधानमूलक लेखन	पदवर्ग (नाम, सर्वनाम, विशेषण र क्रियापद) को प्रयोगात्मक पहिचान	७
४.	जीवनी	(राष्ट्रिय)	- जीवनीको संरचना (जीवन विषयक घटना शृङ्खला, अनुच्छेद योजना, भाषा आदि) को बोध	• जीवनीमा प्रस्तुत घटनाक्रमको वर्णन • आफ्नो समाजमा प्रतिष्ठित कुनै व्यक्तिको जीवनी लेखन • जीवनीबाट प्राप्त सन्देश/शिक्षाको अभिव्यक्ति	(अ) पदवर्ग (नामयोगी, क्रियायोगी, संयोजक, विस्मयादिबोधक र निपात) को प्रयोगात्मक पहिचान (आ) शब्द रूपायन	७

५.	पत्र लेखन	घरायसी	• पत्र लेखनको संरचना (विषय, प्रस्तुतिक्रम, ढाँचा, भाषाशैली आदि) को बोध -	• पत्र लेखनमा प्रस्तुत विषयवस्तु र ढाँचाको टिपोट • विषयको प्रस्तुति • निर्दिष्ट विषयमा पत्र लेखन • निमन्त्रणा, बधाई, शुभकामना, अभिनन्दनपत्र, सम्मानपत्र, सूचना, विज्ञापन, श्रद्धाञ्जली, समवेदनाको ढाँचा र शैलीको अध्ययन तथा लेखन अभ्यास	लेख्य चिह्न र तिनको प्रयोग (पूर्णविराम, अर्धविराम, अल्पविराम, कोष्ठक, विकल्पबोधक/तिर्यक्, प्रश्नवाचक, उद्धरण, विस्मयसूचक/उद्गार, निर्देशक, योजक, छुट चिह्न/कागपादे चिह्न,	८
६.	कथा	मनोवैज्ञानिक	• कथाको संरचना (विषय, अनुच्छेद योजना, घटनाक्रम, संवाद, भाषा आदि) को बोध	• कथाका घटनाहरूको टिपोट • कथाका पात्रहरूको चरित्र वर्णन • पढेका नयाँ कथाका बारेमा प्रस्तुति • लघुकथा लेखन (अनुकरणात्मक)	(अ) वर्णविन्यासको पहिचान र प्रयोग (आ) भाषिक प्रयोगमा पदयोग र पदवियोगको पहिचान र प्रयोग	८
७.	निबन्ध	प्राकृतिक (वस्तुपरक)	• निबन्धको संरचना (विषय प्रस्तुतिको क्रम, अनुच्छेद योजना, भाषाशैली आदि) को बोध • निबन्धको शैली र ढाँचाको अध्ययन	• निबन्धमा वर्णित मुख्य विषयको बुँदाटिपोट, सारांश • प्रकृति तथा वातावरणको वर्णन गरी निबन्ध लेखन • खोज तथा परियोजनामा आधारित भई समालोचनात्मक चिन्तनसहितको लेखन	उपसर्गद्वारा शब्दनिर्माण (अ) अ, अन, कु, बि, बे, बद, गैर, ना (आ) अति, अधि, अनु, अप, अभि, अव, आ, उत्, उप, दुर्, दुस्, नि, निर्, निस्, परा, परि, प्र, प्रति, वि, सम्, सु	७
८.	लघुनाटक	सामाजि/ मनोवैज्ञानिक	• नाटकको संरचना (विषय, प्रस्तुतिक्रम, हाउभाउ, मञ्चीयता, चरित्र, संवाद, भाषाशैली आदि) को बोध	• नाटकका प्रमुख पात्रको चरित्र वर्णन • नाटकका घटना तथा परिवेशको वर्णन • नाटकको संवादात्मक अभिनय (विषयको प्रस्तुति, हाउभाउ)	प्रत्ययद्वारा शब्द निर्माण: (क) अक्कड, अत, अन्त, आइ, आइँ/याइँ, आउ, आली, आलु, आवट, आहा/याहा, इया, (ख) इयार, इलो, ई, उवा, ए, एली, ओ, ओट,	११

				• संवाद लेखन • प्रतिवेदन लेखन (कार्यक्रम, भ्रमण, घटना)	औली/यौली, पन/पना, ली, ले	
९	रिपोर्ताजमूलक रचना	स्वास्थ्य, योग तथा चिकित्सा	• रिपोर्ताजको संरचना (विषय प्रस्तुतिको क्रम, अनुच्छेद योजना, भाषाशैली आदि) को बोध • रिपोर्ताजमा प्रयुक्त कठिन शब्दको अर्थबोध • रिपोर्ताजको ढाँचा र शैलीको अध्ययन	• रिपोर्ताजमा वर्णित मुख्य विषयको बुँदाटिपोट, टिप्पणी लेखन • स्वास्थ्य, योग र चिकित्साको वर्णन गरी रिपोर्ताज लेखन • रिपोर्ताजमा प्रयुक्त कठिन शब्दबाट वाक्य रचना • प्रतिवेदन लेखन ढाँचा र शैलीको अध्ययन र लेखन अभ्यास	प्रत्ययद्वारा शब्द निर्माण: अक, अन, अनीय, इक, इत, ई, ईन/ईण, ईय, क, तर, तम, तव्य, ता, ति, त्व, मय, मान्, वान्, य	८
१०.	संवादात्मक रचना	कृषि, वन तथा वातावरण	• संवादको संरचना (विषय, प्रस्तुतिक्रम, हाउभाउ, तर्क, संवाद, भाषाशैली आदि) को बोध	• संवादमा प्रस्तुत विषयवस्तुको टिपोट • विषयको प्रस्तुति, हाउभाउ • निर्दिष्ट विषयमा संवाद लेखन तथा मौखिक अभिव्यक्ति र अभिनय • उद्घोषण, समाचार वाचन, प्रवचन आदिको अभ्यास	समास प्रक्रियाद्वारा शब्द निर्माण (अव्ययीभाव, कर्मधारय, तत्पुरुष, द्वन्द्व, द्विगु, बहुब्रीहि (समास र विग्रहसमेत)	८
११.	दैनिकी रचना	पर्यटन	• निर्दिष्ट पाठको बोध (अनुमान, संरचना पहिचान आदि) • निर्दिष्ट पाठमा प्रयुक्त प्राविधिक तथा पारिभाषिक शब्दको अर्थबोध	• निर्दिष्ट पाठसँग सम्बन्धित रचना • बुँदाटिपोट र सारांश लेखन • दैनिकी लेखन • अनुकरणात्मक लेखन	(अ) द्वित्व प्रक्रियाद्वारा शब्द निर्माण (पूर्ण, आंशिक र आपरिवर्तित द्वित्व) (आ) सन्धि र सन्धि भएका शब्दको पहिचान	८

१२.	वक्तृतात्मक रचना	जलस्रोत र ऊर्जा	• वक्तृताको संरचना (विषय, प्रस्तुतिक्रम, हाउभाउ, तर्क, संवाद, भाषाशैली आदि) को बोध	• वक्तृतामा प्रस्तुत विषयवस्तुको टिपोट • हाउभाउसहित विषयको प्रस्तुति • निर्दिष्ट विषयमा वक्तृता लेखन तथा मौखिक अभिव्यक्ति र अभिनय • उद्घोषण, समाचार वाचन, प्रवचन आदिको अभ्यास • वक्तृता/वादविवाद आयोजना • विभिन्न ढाँचामा प्रतिवेदन लेखन	(अ) उद्देश्य र उद्देश्य विस्तार तथा विधेय र विधेय विस्तार, पहिचान र प्रयोग (आ) व्याकरणात्मक कोटिका आधारमा वाक्य परिवर्तन (लिङ्ग, वचन, पुरुष, आदर) (इ) कथन (प्रत्यक्ष, अप्रत्यक्ष) (ई) ध्रुवीयता (करण, अकरण)	९
जम्मा						९६

(ख) कक्षा : १२

क्रम सङ्ख्या	पाठ	क्षेत्र	बोध	अभिव्यक्ति	भाषातत्त्व	पाठ्यघण्टा
१.	कविता (गद्य कविता)	सामाजिक	• कविताको संरचना (विषयको क्रम, भाषा, शैलीको बोध आदि) • गद्य कविताको लयबोध	• कवितालाई अनुच्छेदमा रूपान्तर • कविताको लयबद्ध वाचन • कविता सिर्जनाको अभ्यास	नेपाली अक्षरको पहिचान र उच्चारण अभ्यास	७
२.	कथा	ऐतिहासिक/ पौराणिक/ सांस्कृतिक	• कथाको संरचना (विषय, अनुच्छेद योजना, घटनाक्रम, संवाद, भाषा आदि) को बोध	• कथामा प्रयुक्त घटनाहरूको सिलसिलाबद्ध टिपोट • निर्देशित वा स्वतन्त्र कथा लेखन अभ्यास • विद्युतीय तथा सञ्चार माध्यममा प्रकाशित कथाहरूको अध्ययन र प्रभावको प्रस्तुति	पदवर्ग (नाम, सर्वनाम, विशेषण र अव्यय) को पहिचान र प्रयोग	७
३.	निबन्ध	नियात्रा	• निबन्धको संरचना (विषय प्रस्तुतिको क्रम, अनुच्छेद योजना, भाषाशैली आदि) को	• आफूले गरेको कुनै यात्राको वर्णन • निबन्ध लेखन • विद्युतीय सञ्चार माध्यम	(अ) पदसङ्गति (क) लिङ्ग (ख) वचन	७

			बोध • निबन्धमा प्रयुक्त कठिन शब्दको अर्थबोध	र प्रकाशित उपयोगी लेख रचनाहरूको अध्ययन र त्यसबाट प्राप्त विषयवस्तु, सन्देश आदिको प्रस्तुति • तार्किक, अन्तरक्रियात्मक एवम् समस्या समाधानमूलक लेखन	(ग) पुरुष (घ) आदर (सामान्य, मध्यम, उच्च) (आ) शब्द रूपायन	
४.	पत्र लेखन (व्यावसयिक)		• पत्र लेखनको संरचना (विषय, प्रस्तुतिक्रम, ढाँचा, भाषाशैली आदि) को बोध –	• पत्र लेखनमा प्रस्तुत विषयवस्तुको टिपोट • विषयको प्रस्तुति • निर्दिष्ट विषयमा पत्र लेखन • भरपाई, तमसुक, करारनामा, मञ्जुरीनामा, मुचुल्का, प्रशासनिक टिप्पणी, बैठक निर्णय, विज्ञापन, सूचना, विज्ञप्ति, बोलपत्र, सम्पादकलाई चिठीको ढाँचा र शैलीको अध्ययन र लेखन अभ्यास • विद्युतीय सञ्चार माध्यममा उपलब्ध प्रयोजनपरक सामग्रीको अध्ययन र लेखन अभ्यास	वाक्यको पहिचान र प्रयोग (क) सरल, संयुक्त र मिश्र वाक्यको पहिचान र प्रयोग (ख) निर्धारित कथाबाट सरल, मिश्र र संयुक्त वाक्यको पहिचान र वाक्यान्तरण	८
५.	उपन्याको अंश	सामाजिक	• उपन्यास अंशको संरचना (विषय, परिच्छेद योजना, घटना शृङ्खला, पात्र, संवाद, भाषाशैली आदि) को बोध • शब्दभण्डारको बोध .	• उपन्यास अंशको विषयवस्तु वर्णन • उपन्यासको अंशका प्रमुख पात्रको चरित्र वर्णन • उपन्यासको अंशको घटना तथा परिवेशको वर्णन • आफूले अध्ययन गरेको कुनै एक उपन्यासको विषयवस्तु, पात्र, परिवेश, सन्देश आदि बारेमा मौखिक तथा लिखित अभिव्यक्ति	क्रियाका काल (भूत, अभूत) पक्ष : अपूर्ण, पूर्ण, अज्ञात, अभ्यस्त (आ) नेपाली वर्णविन्यासको प्रयोगात्मक अभ्यास	१४
६.	जीवनी	अन्तर्राष्ट्रिय	• जीवनीको संरचना (जीवन विषयक घटना शृङ्खला, अनुच्छेद योजना, भाषा आदि) को बोध	• जीवनीमा प्रस्तुत घटनाक्रमको वर्णन • आफ्नो समाजमा प्रतिष्ठित कुनै व्यक्तिको जीवनी लेखन	क्रियाका भाव : सामान्य, आज्ञा, इच्छा, सम्भावना, सङ्केत	७

				• खोज तथा परियोजनामा आधारित भई समालोचनात्मक चिन्तनसहितको लेखन		
७.	गीति कविता	सामाजिक /सांस्कृतिक	• कविताको संरचना (विषयको क्रम, भाषा, लय आदि) को बोध • पद्य र गद्य कविताको लयबोध • गजलको संरचना बोध	• कविताको लयबद्ध वाचन • गीति कविता सिर्जना • विद्युतीय सञ्चारमा उपलब्ध मुक्तक तथा कवितात्मक सामग्रीको अध्ययन र कक्षामा प्रस्तुति • गजलको रचना	उपसर्ग र प्रत्ययद्वारा शब्द निर्माणसम्बन्धी अभ्यास	७
८.	कथा	समाज मनोवैज्ञानिक	• कथाको संरचना (विषय, अनुच्छेद योजना, घटनाक्रम, संवाद, भाषा आदि) को बोध	• कथामा वर्णित घटनाको सिलसिलाबद्ध टिपोट • कथाका पात्रहरूको चरित्र वर्णन • कथा सिर्जनाको अभ्यास • आफूले अध्ययन गरेको कम्तीमा कुनै एक उपन्यासको विषयवस्तु, पात्र, परिवेश, सन्देश आदि बारेमा मौखिक तथा लिखित अभिव्यक्ति	द्वित्व र समास प्रक्रियाद्वारा शब्द निर्माणसम्बन्धी अभ्यास	७
९.	आख्यानात्मक रचना	सञ्चार, विज्ञान तथा प्रविधि	• आख्यानको संरचना (विषय, अनुच्छेद योजना, घटनाक्रम, संवाद, भाषा आदि) को बोध	• आख्यानमा वर्णित घटनाको सिलसिलाबद्ध टिपोट • आख्यानका पात्रहरूको चरित्र वर्णन • कथा सिर्जनाको अभ्यास • आफूले अध्ययन गरेको कुनै एक आख्यानको विषयवस्तु, पात्र, परिवेश, सन्देश आदि बारेमा मौखिक तथा लिखित अभिव्यक्ति	कारक र विभक्तिको पहिचान र प्रयोग (अ) कारकका सरल र तिर्यक् रूप (आ) कारकका प्रकार : कर्ता, कर्म, करण, सम्प्रदान, अपादान, अधिकरण (इ) विभक्तिको प्रयोग	८
१०.	संवादात्मक रचना	समाज, संस्कृति र शिक्षा	• संवादको संरचना (विषय, प्रस्तुतिक्रम, हाउभाउ, तर्क, संवाद, भाषाशैली आदि) को बोध	• संवादमा प्रस्तुत विषयवस्तुको टिपोट • हाउभाउसहित विषयको प्रस्तुति • निर्दिष्ट विषयमा संवाद लेखन तथा मौखिक	(क) वाक्य संश्लेषण र विश्लेषण (ख) वाच्य (कर्तृ, कर्म, भाव) को पहिचान र प्रयोग	८

				अभिव्यक्ति र अभिनय • शिक्षा र सांस्कृतिक शीर्षकमा वक्तव्य, समाचार वाचन, प्रवचन आदिको अभ्यास		
११.	प्रबन्धात्मक रचना	कानुन, प्रशासन र व्यवस्थापन	• प्रबन्धको संरचना (विषय प्रस्तुतिको क्रम, अनुच्छेद योजना, भाषाशैली आदि) को बोध • प्रबन्धमा प्रयुक्त कठिन शब्दको अर्थबोध	• प्रबन्धमा वर्णित मुख्य विषयको बुँदाटिपोट, सारांश • प्रकृति तथा वातावरणको वर्णन गरी प्रबन्ध लेखन • प्रबन्धमा प्रयुक्त कठिन शब्दबाट वाक्य रचना • बैठक (माइन्युट) को उपस्थिति तथा निर्णय एवम् भरपाई, मुचुल्का र प्रशासनिक टिप्पणीको नमुना लेखन • व्यक्तिगत विवरण (बायोडाटा) लेखन	(अ) पदक्रम (क) सामान्य पदक्रम (ख) विशिष्ट पदक्रम (आ) लेख्य चिह्न र तिनको प्रयोग	८
१२.	रिपोर्ताजमूलक रचना	अर्थ, उद्योग र वाणिज्य	• रिपोर्ताज पाठको बोध (अनुमान, संरचना पहिचान आदि) • रिपोर्ताज पाठमा प्रयुक्त प्राविधिक तथा पारिभाषिक शब्दको अर्थबोध • विभिन्न पत्रिकामा प्रकाशित रिपोर्ताजको अध्ययन र प्रस्तुति	• निर्दिष्ट पाठसँग सम्बन्धित रचना • बुँदाटिपोट र सारांश लेखन • निर्दिष्ट अनुच्छेदको उत्तर लेखन • अनुकरणात्मक लेखन • विद्युतीय सञ्चार माध्यममा आधारित विविध लेखन अभ्यास	(अ) उक्ति परिवर्तन (आ) उद्देश्य र विधेय विस्तार (इ) शब्दकोशीय प्रयोग	८
जम्मा						९६

द्रष्टव्य :

(क) विधाको माध्यमबाट विद्यार्थीले बोध, अभिव्यक्ति र भाषातत्त्वअन्तर्गतका विषयवस्तुको सिकाइ गरी भाषिक सिपहरू र भाषिक कार्यहरूमा आवश्यक सक्षमताको विकास गर्नेछन् ।

(ख) रिपोर्ताजमूलक रचना भनेको कुनै पनि विषयमा गरिएको खोजमूलक र आख्यानात्मक संरचना भएको तथ्यमा आधारित समसामयिक प्रचलित लेखन हो ।

(ग) पाठ्यपुस्तक विकास गर्दा प्रयोजनपरक रचनाहरूलाई साहित्यिक विधासँग सम्बन्धित पाठहरूको बिचमा आवश्यकतानुसार क्रम मिलाएर राख्नुपर्ने छ ।

(घ) विधाको क्षेत्र तथा क्रम र विस्तृतीकरणमा उल्लेख भएका पाठहरूमा प्रयोग भएका आधारमा उपयुक्तताअनुसार शब्दभण्डारको अभ्यास गराउनुपर्ने हुन्छ । यसका लागि पर्यायवाची शब्द, विपरीतार्थी शब्द, अनुकरणात्मक शब्द, अनेकार्थी शब्द, श्रुतिसमभिन्नार्थक शब्द, सङ्क्षिप्त शब्द, उखान टुक्का, लघुतावाची शब्द, सिङ्गो शब्द, समूहवाचक शब्द, पारिभाषिक/ प्राविधिक जस्ता शब्दहरूको अर्थ र सन्दर्भपूर्ण

प्रयोगको अभ्यास गराउनु अपेक्षित छ । पाठमा प्रयुक्त भएका शब्दहरूलाई केन्द्रबिन्दु मानी विभिन्न का शब्दभण्डारको विकास गराउने दृष्टिकोण यसमा राखिएको छ । शब्दका विभिन्न अर्थ सम्बन्धहरू र गत विविधतालाई ख्याल राखी शब्दहरूको अर्थ र सन्दर्भपूर्ण प्रयोगमा जोड दिइने छ । यस क्रममा प्रयुक्त र तत्सम्बन्धी उखान टुक्काहरूको प्रयोगलाई पनि समावेश गरिने छ ।

(ङ) यस पाठ्यक्रम कार्यान्वयन र शिक्षण सिकाइका क्रममा सिर्जनात्मक सोचाइ/चिन्तन, समस्या समाधान, विद्युतीय सञ्चार सिप, सहकार्य र स्वव्यस्थापन, खोज, अन्वेषण, तार्किकता जस्ता भाषासम्बद्ध जीवनोपयोगी सिपहरूलाई यथासम्भव एकीकृत गरिने छ ।

५. सिकाइ सहजीकरण प्रक्रिया

सिकाइ सहजीकरण पाठ्यक्रमलाई कक्षाकोठामा प्रभावकारी रूपमा हस्तान्तरण गर्ने विधि हो । भाषा शिक्षणमा भाषिक सिपको विकासका लागि सिकाइ सहजीकरण प्रक्रिया अपरिहार्य हुन्छ । भाषा शिक्षणका क्रममा विद्यार्थीलाई सक्रिय गराएर सिकाइलाई विद्यार्थीकेन्द्रित बनाउनुपर्छ । यसका लागि कक्षाकोठामा बहुभाषिक, स्थिति भएमा पहिलो भाषा र दोस्रो भाषाका रूपमा नेपाली शिक्षणका विधिमा ध्यान पुऱ्याउनुपर्छ । सिकाइ सहजीकरण प्रक्रिया पाठ्यक्रमको उद्देश्य, विषयवस्तु, विद्यार्थीको पृष्ठभूमि, स्थानीय स्रोत साधनको उपलब्धता आदिमा निर्भर हुन्छ । यो व्यक्तिगत र सामूहिक अभ्यासमा पनि आधारित हुन्छ । यस पाठ्यक्रममा सिकाइ सहजीकरणका सिपमा आधारित विधागत शिक्षणमा जोड दिइने छ । भाषा शिक्षण भाषाका सिपहरूको शिक्षण हो । भाषाका सुनाइ, बोलाइ, पढाइ र लेखाइ सिपको एकीकृत शिक्षण गरेर नै भाषाको शिक्षण गरिन्छ । साहित्यिक विधा तथा प्रयोजनपरक पाठका माध्यमबाट भाषिक सिपको शिक्षण गर्नु भाषा सिकाइको मूल पक्ष हो । भाषा शिक्षणमा साहित्यिक विधा र प्रयोजनपरक भेदहरूको निम्नअनुसार उपयोग गरिन्छ :

(क) कविता

कविता भाषाको लययुक्त भेद हो । कविताको शिक्षण गर्दा लयबोध, शब्दार्थ र वाक्यमा प्रयोग, संरचना (आदि, मध्य र अन्त्य) बोध, भावबोध, व्याख्या जस्ता क्रियाकलाप गराउनुपर्दछ । कविता शिक्षण गर्दा पूर्व तयारी, पठन वा श्रवण र पठनपश्चात्का चरणमा बाँडी पठन पृष्ठभूमि, उद्देश्य निर्धारण, प्रश्नको सूची, प्रश्नोत्तर, भावबोध जस्ता क्रियाकलाप गराउनुपर्दछ । यसका लागि नमुना कविता दिई अनुकरणात्मक लेखन गराउने र सिर्जनात्मक अभ्यास पनि गराउनुपर्दछ ।

(ख) कथा

कथा आख्यानात्मक विधा हो । आख्यानात्मक स्वरूपका कारण कथा रुचिपूर्ण हुन्छ । कथा शिक्षण गर्दा उच्चारण, गति, यतिसहित हाउभाउपूर्ण पठन गराइन्छ । कथाबाट कथाकथन, घटना वर्णन, घटना टिपोट, बोध, प्रश्नोत्तर, भाव वर्णन र अनुकरणात्मक तथा स्वतन्त्र सिर्जनात्मक अभ्यास गराउनुपर्छ । पठन क्रियाकलापलाई योजनाबद्ध रूपमा प्रस्तुत गराउन कथा विधा उपयोगी हुन्छ । कथा शिक्षण गर्दा पूर्वपठन, पठन र पठनपश्चात्का चरणमा बाँडी पूर्वानुमान गर्ने, सहकार्यात्मक पठन, छलफल र प्रस्तुतीकरण गर्ने तथा प्रश्न निर्माण गराउने क्रियाकलाप पनि गराउनुपर्छ ।

(ग) निबन्ध

निबन्ध गद्य विधा हो । निजात्मक र वस्तुपरक अनुभूतिका लागि निबन्ध उपयुक्त विधा हो । निबन्ध शिक्षण गर्दा शब्दार्थ र वाक्यमा प्रयोग, पठनबोध, विषयबोध, बुँदाटिपोट, व्याख्या, सारांश, प्रश्नोत्तर, अनुच्छेद लेखन र स्वतन्त्र लेखन जस्ता क्रियाकलाप गराउनुपर्छ । यो लेखाइ सिप विकासका लागि उपयुक्त विधा हो । परियोजना कार्य, घटना अध्ययन, कक्षा छलफल र प्रस्तुतीकरण जस्ता क्रियाकलाप गराएर निबन्ध लेखन क्रियाकलाप गराउनुपर्छ ।

(घ) जीवनी

जीवनी भाषाको गद्य भेद हो । जीवनीबाट विद्यार्थीलाई घटना वर्णन, घटना लेखन, बुँदाटिपोट, प्रश्नोत्तर, सारांश लेखन र जीवनी लेखन जस्ता अभ्यास गराउनुपर्छ । जीवनी लेखनसँगसम्बद्ध गराएर अन्तर्वार्ता, परियोजना कार्य, घटना अध्ययन जस्ता क्रियाकलाप गराउनुपर्छ । जीवनी शिक्षणबाट मूलत: भाषाका पढाइ र लेखाइ सिपको विकास हुने भए पनि लेखन अभ्याससम्बन्धी क्रियाकलाप बढी प्रभावकारी हुन्छ । यसका लागि नमुना जीवनी प्रस्तुत गर्दै अनुकरणात्मक जीवनीमा अभ्यास गराई स्वतन्त्र अभ्यास गराउनुपर्छ ।

(ङ) रूपक

रूपक भनेको अभिनयात्मक विधा हो । यसमा पात्रले परिस्थिति, अवस्था, विषयवस्तु र व्यक्ति विशेषको चारित्रिक भूमिकालाई ध्यानमा राखेर हाउभाउसहित भूमिका निर्वाह गर्छ । यो कथ्य भाषासँग सम्बन्धित भएकाले मौखिक अभिव्यक्तिका माध्यमले

व्यक्तिका भावना, चारित्र आदिको प्रदर्शन गरिन्छ । नाटक, एकाङ्की, संवाद, वादविवाद, मनोवाद, वक्तृता आदिका माध्यमबाट रूपकीय प्रस्तुति गरिन्छ । तसर्थ रूपकको प्रकारअनुसार हाउभाउ प्रदर्शन गरी विचारको प्रस्तुतीकरण र व्यवहार गर्ने, अभिनयात्मक ढङ्गबाट अरूले गरेका व्यवहारको अनुकरण गर्ने, जीवन्त रूपमा मौखिक भाषाको प्रयोग गर्ने, तार्किक क्षमताको विकास गर्ने जस्ता क्रियाकलापबाट रूपक शिक्षण गर्नुपर्छ । साथै अभिनयात्मक कलाका अतिरिक्त रूपक विधाबाट अन्य भाषिक सिपको पनि अभ्यास गराउन सकिन्छ ।

(च) प्रयोजनपरक पाठहरू

दैनिक जीवनमा प्रयोगमा आउने विभिन्न समसामयिक का ज्ञान, सिप एवम् विविध प्राविधिक र पारिभाषिक शब्दका माध्यमबाट भाषा सिकाइमा सहजता प्रदान गर्नका लागि यस तहमा प्रयोजनपरक रचनाहरू समावेश गरिएको छ । यसमा सिकारुका दैनिक जीवनयापन र व्यावसायिक क्षेत्रमा आवश्यक पर्ने ज्ञान, सिप, अभिवृद्धि, मूल्य र काम गर्ने तत्परतालाई व्यावहारिक रूपले उपयोग गर्न सक्ने गरी स्वास्थ्य, योग तथा चिकित्सा, कृषि, वन तथा वातावरण, पर्यटन, जलस्रोत र ऊर्जा, सञ्चार, विज्ञान तथा प्रविधि, समाज, संस्कृति र शिक्षा, कानुन, प्रशासन र व्यवस्थापन, अर्थ, उद्योग र वाणिज्य जस्ता विषयमा आधारित रचनालाई समावेश गरिएको छ । यस्ता रचनाका माध्यमबाट विद्यार्थीले वाणिज्य, अर्थ, विज्ञान, स्वास्थ्य, कानुन, शिक्षा, योग जस्ता विषयको रचनात्मक, प्रयोजनपरक भाषिक प्रयोग र संरचनाको अभ्यास गराइने छ । प्रयोजनपरक पाठहरूलाई रोचक बनाउनका लागि साहित्यिक विधाका रूपमा प्रस्तुत गरिने छ । सिकाइ सहजीकरणका क्रममा विभिन्न प्रयोजनपरक शीर्षक दिई तिनमा अनुकरणात्मक, निर्देशनात्मक र स्वतन्त्र लेखनको अभ्यास गराइन्छ । उदाहरणमा आधारित पाठ वा रचनाको अभ्यास, पाठको मौखिक र लिखित अभिव्यक्ति, समूह छलफल र प्रस्तुतीकरण, परियोजना र खोजमूलक कार्य गराउने अभ्यास गराउनुपर्दछ । त्यस्तै आवश्यकतानुसार प्रचलित र सान्दर्भिक विद्युतीय सञ्चार माध्यममा उपलब्ध उपयोगी सामग्रीको अध्ययन गरी कक्षामा प्रस्तुत गर्न लगाउनुपर्छ ।

७. विद्यार्थी मूल्याङ्कन प्रक्रिया

मूल्याङ्कन गर्दा निर्माणात्मक र निर्णयात्मक दुई किसिमका प्रक्रिया अपनाइने छ । निर्णयात्मक मूल्याङ्कन गर्दा आन्तरिक र बाह्य गरी दुई तरिका अवलम्बन गरिने छ । निर्णयात्मक मूल्याङ्कनका लागि निर्माणात्मक मूल्याङ्कनमा उपयोग गरिएका विभिन्न प्रक्रिया, साधनहरू तथा तिनको अभिलेखीकरणलाई समेत आधार बनाउन सकिने छ । निर्माणात्मक मूल्याङ्कन शिक्षण सिकाइ सहजीकरण प्रक्रियाकै निरन्तरता मानिने भएकाले यसलाई निरन्तर मूल्याङ्कनका रूपमा प्रयोग गर्न सकिन्छ । स्तरोन्नति तथा कक्षोन्नतिका लागि शैक्षिक सत्रको अन्तमा निर्णयात्मक मूल्याङ्कन अन्तिम परीक्षाका माध्यमबाट गरिने छ । निर्माणात्मक वा निरन्तर मूल्याङ्कनमा क्षेत्रीय अध्ययन, परियोजना कार्य, अध्ययन भ्रमण, घटना अवलोकन तथा अध्ययन, सिर्जनात्मक तथा रचनात्मक कार्य, विद्युतीय सञ्चार माध्यममा प्राप्त सान्दर्भिक सामग्रीको अध्ययन र प्रस्तुति, सिकारुका कार्यकलापको निरीक्षण, व्यक्तिगत र सामूहिक छलफल, लिखित परीक्षा, हाजिरीजवाफ, प्रश्नोत्तर, कक्षाकार्यको परीक्षण, भाषिक व्यवहारको निरन्तर अवलोकन र तिनको अभिलेखीकरण जस्ता साधनहरूको उपयोग गरिने छ ।

नेपाली भाषाको मूल्याङ्कनमा सक्षमता र सिकाइ उपलब्धिमा लेखिएका भाषिक सिपको मापन गरिने छ । विद्यार्थीको भाषिक सिपगत सक्षमताको मापनगर्ने प्रश्नहरूको निर्माण गर्दा व्याकरण र शब्दभण्डारसम्बन्धी प्रश्नहरूसमेत भाषिक एकाइ र रचनामा केन्द्रित गरिने छ । व्याकरणको मूल्याङ्कन कार्यमूलक प्रकृतिको हुने छ । प्रश्नहरू विद्यार्थीको भाषिक दक्षताका अतिरिक्त रचनात्मक र समालोचनात्मक क्षमतालाई पनि सम्बोधन गर्ने खालका हुने छन् ।

(क) आन्तरिक मूल्याङ्कन

आन्तरिक तथा प्रयोगात्मक मूल्याङ्कनका लागि प्रत्येक विद्यार्थीहरूको कार्यसञ्चयिका फाइल बनाई सोको आधारमा उनीहरूको कार्य र उनीहरूले गरेका कार्य र उनीहरूमा आएको व्यवहार परिवर्तनका अभिलेख राखी सोका आधारमा अङ्क प्रदान गर्नुपर्दछ । सिकाइका क्रममा कक्षाकोठामा कक्षागत शिक्षण सिकाइको अभिन्न अङ्गका रूपमा गृहकार्य, कक्षाकार्य, परियोजना कार्य, सामुदायिक कार्य, सह/अतिरिक्त क्रियाकलाप, एकाइ परीक्षा, मासिक परीक्षा जस्ता मूल्याङ्कन साधनहरूको प्रयोग गर्न सकिने छ । यस्तो मूल्याङ्कनका लागि विद्यार्थीको अभिलेख राखी त्यही अभिलेखका आधारमा सिकाइस्तर निर्धारण गर्न सकिन्छ । आवश्यकतानुसार सुधारात्मक तथा उपचारात्मक शिक्षण सिकाइ क्रियाकलाप सञ्चालन गर्नुपर्छ । विशेष सिकाइ आवश्यकता भएका विद्यार्थीका लागि विषय शिक्षकले नै उपयुक्त प्रक्रिया अपनाई मूल्याङ्कन गर्नुपर्ने छ । यस विषयमा निर्माणात्मक

मूल्याङ्कन प्रक्रियाको महत्त्वपूर्ण भूमिका रहेको हुन्छ । विद्यार्थीहरूले के कति सिके भन्ने कुरा पत्ता लगाई नसिकेको भए कारण पहिचान गरी पुन: सिकाइनुपर्छ । आन्तरिक मूल्याङ्कनको भार २५% छुट्याइएको छ । यस विषयको आन्तरिक मूल्याङ्कनमा कक्षा सहभागिता, कक्षा कार्य/परियोजना कार्य, विषयवस्तुको मूल्याङ्कन तथाा आन्तरिक परीक्षाबाट प्राप्त विद्यार्थीको सिकाइ उपलब्धिलाई समेटिनु पर्दछ ।

यस खण्डको मूल्याङ्कन विद्यार्थीले व्यक्तिगत तथा समूह कार्य तथा परियोजनाको गुणस्तरको आधारमा विद्यालय तहमा गठन गरिने मूल्याङ्कन समितिले गर्ने छ भने तोकिएको निकायबाट यसको प्राविधिक परीक्षण हुने छ । आन्तरिक मूल्याङ्कनका आधारहरू र अङ्क विभाजन निम्नानुसार हुने छ :

आन्तरिक मूल्याङ्कनको विस्तृतीकरण

क्र.सं	**क्षेत्र**	**परीक्षण गर्ने पक्ष**	**अङ्कभार**	**मूल्याङ्कनका आधार**
१.	सहभागिता	कक्षा सहभागिता	३	विद्यार्थीको दैनिक हाजिरीको अभिलेखलाई आधार लिने भाषिक सिप विकासका लागि व्यक्तिगत, युगल र समूहगत आदि कक्षागत सिकाइ सहभागितालाई आधार मान्ने
२.	कक्षा कार्य/परियोजना कार्य	कक्षा कार्य/परियोजना कार्य	६	सुनाइ, बोलाइ, पढाइ, लेखाइ सिप विकाससम्बद्ध लिखित तथा मौखिक प्रस्तुति, गृहकार्य, कक्षा कार्य वा भाषिक सिप विकाससम्बन्धी परियोजना कार्यको प्रतिवेदन र अन्तर्वार्ता (भाइबा) लाई आधार लिने
३.	विषयवस्तुगत मूल्याङ्कन	(क) सुनाइ	३	रेडियो, क्यासेट, मोबाइल वा अन्य विद्युतीय सामग्रीबाट समाचार, संवाद, साहित्यिक अभिव्यक्ति, वा अन्य सन्देशमूलक गद्यांश सुनाएर अनुमान, पूर्वानुमान, प्रश्नोत्तर, शब्दबोध, अर्थबोध, सन्दर्भबोध, भावबोध, कथाकथन, घटना वर्णन, मुख्य बुँदा टिपोट आदिसँग सम्बन्धित प्रश्नहरू सोधी भन्न वा लेख्न लगाउने । वा १५० देखि २०० शब्दसम्मको कुनै गद्यांश वा पद्यांश (अदृष्टांश) सुनाएर अनुमान, पूर्वानुमान, प्रश्नोत्तर, शब्दबोध, अर्थबोध, सन्दर्भबोध, भावबोध, कथाकथन, घटना वर्णन, मुख्य बुँदा टिपोट आदिसँग सम्बन्धित प्रश्नहरू सोध्ने ।
		(ख) बोलाइ		
		(अ) मौखिक वर्णन/ कथा कथन	४	कुनै विषयवस्तु, चित्र, परिवेश आदि दिएर मौखिक वर्णन गर्न लगाउने (यसरी वर्णन गर्दा वक्ताले बोलेको कुरामा स्पष्टता, शैली, भाषिक स्तर, शुद्धोच्चारण, गति, यति, लय र हाउभाउ जस्ता पक्षमा ध्यान दिने) वा कुनै कथा सुनी कथाकथन गर्न लगाउने, घटना, पात्र र परिवेशको वर्णन गर्न लगाउने

		(आ) सस्वरवाचन	३	कुनै पत्रपत्रिका वा कुनै लिखित सामग्रीबाट १५० शब्दसम्मको गद्यांश वा पद्यांश दिएर गति, यति, लय मिलाएर भावानुकूल सस्वरवाचन गर्न लगाउने । (यसरी वाचन गर्दा स्पष्टता, भाषिक शुद्धता, गति, यति, लय र हाउभाउ जस्ता पक्षमा विशेष ख्याल गर्ने)
४	त्रैमासिक परीक्षा	त्रैमासिक परीक्षाको अङ्कबाट	६	पहिलो त्रैमासिक परीक्षाबाट ३ अङ्क र दोस्रो त्रैमासिक परीक्षाबाट ३ अङ्क
	जम्मा		२५	

द्रष्टव्य : आन्तरिक मूल्याङ्कनका आधारको विस्तृत विवरण आन्तरिक मूल्याङ्कन कार्यविधिका आधारमा हुने छ ।

(ख) बाह्य मूल्याङ्कन

(आ) भाषिक सिप (पढाइ र लेखाइ) कक्षा ११

क्र.सं	**भाषिक सिप (पढाइ र लेखाइ)**	**विषयक्षेत्र**	**अङ्कभार**
१.	वर्ण पहिचान	व्याकरण	३
२.	वर्णविन्यास	व्याकरण	३
३.	पदवर्ग पहिचान	व्याकरण	२
४.	शब्दनिर्माण	व्याकरण	४
५.	रूपायन र पदसङ्गति	व्याकरण	३
६.	काल, पक्ष, भाव र वाच्य	व्याकरण	५
७.	शब्दस्रोत र शब्दकोशीय प्रयोग	व्याकरण	२
८.	वाक्यान्तरण	व्याकरण	३
९.	पठनबोध	प्रयोजनपरक रचना	८
१०.	बुँदाटिपोट र सारांश	गद्य रचना	२ + ३ = ५
११.	पाठगत बोध (सन्दर्भमा आधारित छोटो उत्तरात्मक)	कथा, कविता, निबन्ध, जीवनी, रूपक, प्रयोजनपरक रचना	८
१२.	पाठगत बोध (समीक्षात्मक)	कथा, कविता, निबन्ध, जीवनी, प्रयोजनपरक रचना	४+४=८

१३.	स्वतन्त्र रचना	निबन्ध	८
१४.	प्रतिक्रिया लेखन	सामयिक विषय	४
१५.	व्यावहारिक लेखन	व्यावहारिक लेखन, पत्ररचना	४
१६.	प्रतिवेदन तथा टिप्पणी लेखन	प्रतिवेदन र टिप्पणी	५
जम्मा			७५

कक्षा १२

क्र.सं	**भाषिक सिप (पढाइ र लेखाइ)**	**विषयक्षेत्र**	**अङ्कभार**
१.	अक्षर संरचना	व्याकरण	३
२.	वर्णविन्यास	व्याकरण	३
३.	पदवर्ग पहिचान	व्याकरण	३
४.	शब्दनिर्माण	व्याकरण	३
५.	कारक र विभक्ति तथा पदसङ्गति	व्याकरण	४
६.	काल, पक्ष, भाव र वाच्य	व्याकरण	५
७.	वाक्यान्तरण	व्याकरण	४
८.	पठनबोध	प्रयोजनपरक रचना	८
९.	बुँदाटिपोट र सारांश	गद्य विधा	२+३=५
१०.	पाठगत बोध (सन्दर्भमा आधारित उत्तरात्मक)	उपन्यास, कथा, कविता, निबन्ध, जीवनी र प्रयोजनपरक रचना	८
११.	पाठगत बोध (समीक्षात्मक)	उपन्यास, कथा, कविता, निबन्ध, जीवनी, प्रयोजनपरक रचना	४+४=८
१२.	स्वतन्त्र रचना	निबन्ध	८
१३.	प्रतिक्रिया लेखन	प्रतिक्रिया	४
१४.	व्यावहारिक लेखन	व्यावहारिक लेखन, पत्ररचना	४
१५.	प्रतिवेदन तथा टिप्पणी लेखन	प्रतिवेदन	५
जम्मा			७५

सामाजिक अध्ययन

कक्षा १२

साप्ताहिक पाठ्यघण्टा : ३ **वार्षिक पाठ्यभार : ९६ घण्टा**

१. परिचय

शिक्षालाई ज्ञान, सिप, अभिवृत्ति, नेतृत्वकला आर्जन गर्ने, समालोचनात्मक विश्व दृष्टिकोणका आधारमा समाजका घटना परिघटनाको व्याख्या गर्ने र समाज रूपान्तरणमा महत्त्वपूर्ण योगदान गर्ने साधनका रूपमा लिइन्छ । शिक्षालाई समयसापेक्ष बनाउन यसलाई समुदायसँग जोड्नुपर्दछ । व्यक्तिले आफू, परिवार, समाज, राष्ट्र र विश्व परिवेशसँग सामञ्जस्य कायम गर्दै समयानुकूल, स्वच्छ, स्वस्थ र मर्यादित जीवन निर्वाहका लागि क्रियाशील रहन शारीरिक, मानसिक तथा संवेगात्मक व्यवस्थापन गर्नु आवश्यक हुन्छ । मानव जीवनलाई सहज, उन्नत एवम् सुसंस्कृत बनाउन र सामाजिक सम्बन्धहरूलाई न्यायपूर्ण, सौहार्द्रपूर्ण एवम् सहयोगात्मक बनाउँदै लैजान शिक्षाको महत्वपूर्ण भूमिका हुन्छ । समाजलाई समुन्नति र सभ्यतातर्फ अघि बढाउने एउटा प्रभावकारी माध्यमका रूपमा शिक्षालाई लिइन्छ । विश्वमा ज्ञान, विज्ञान र प्रविधिलगायत राजनीति, अर्थतन्त्र, संस्कृति र सामाजिक सम्बन्धहरूमा समेत परिवर्तनहरू आइरहेका हुन्छन् । यस्ता परिवर्तनलाई सम्बोधन गर्न समुदायलाई शिक्षाको पाठ्यक्रमका रूपमा लिई सिकाइका कार्यहरू सञ्चालन गर्नुपर्दछ । विद्यार्थीहरूलाई विद्यालय तहदेखि नै समाज र वातावरणसँग अन्तरक्रिया गर्ने अवसर प्रदान गर्नु पनि आवश्यक छ । यस्तै किशोरकिशोरीमा उत्पन्न हुने द्विविधाहरू व्यवस्थापन गरी कार्यमूलक जीवनमा प्रवेश गर्दा आवश्यक पर्ने जीवनोपयोगी सिपहरू विद्यालय तहमै हासिल गराउनु औचित्यपूर्ण हुन्छ । विद्यालय शिक्षाको राष्ट्रिय पाठ्यक्रम प्रारूप, २०७६ अनुसार कक्षा १२ का विद्यार्थीमा समाजको अध्ययनसहित जीवनोपयोगी सिप विकास गराई मानवीय मूल्य र मान्यतासहित लोकतान्त्रिक समाजमा अनुकूलन हुन सक्ने सक्षम नागरिक तयार पार्ने उद्देश्यले सामाजिक अध्ययनको यो पाठ्यक्रम तयार गरिएको छ ।

यस पाठ्यक्रममा समाज तथा सामाजिकीकरण, मानवसमाजको उद्भव र विकास, नेपाल र विश्वभूगोल, नेपालको सामाजिक तथा सांस्कृतिक मूल्य मान्यताहरू, नेपाल र विश्वको ऐतिहासिक विकासक्रम, नागरिक सचेतना र संविधान, जीवनोपयोगी सिप, वातावरण र जनसाङ्ख्यिकी जस्ता विषय समेटिएको छ । यस पाठ्यक्रमले ज्ञान, सिप, अभिवृत्ति र मूल्यको विकासमा जोड दिएकाले अध्ययन अध्यापनमा सैद्धान्तिकभन्दा व्यावहारिक र प्रयोगात्मक पक्षमा बढी जोड दिनुपर्ने हुन्छ । यस विषयका लागि साप्ताहिक ३ पाठ्यघण्टा र वार्षिक कुल ९६ कार्यघण्टा छुट्याइएको छ । विषयवस्तुमा ७२ कार्यघण्टाको सैद्धान्तिक तथा २४ कार्यघण्टाको व्यावहारिक अभ्यास समावेश गरिएको छ । मूल्याङ्कनलाई सिकाइ सहजीकरण प्रक्रियाको अभिन्न अङ्गका रूपमा प्रयोग गर्नुपर्ने पक्षलाई जोड दिइएको छ । यसका लागि विद्यार्थीमा आवश्यक सामाजिक अध्ययनको ज्ञान, सिप, अभिवृत्ति र मूल्यहरू हासिल भए नभएको परीक्षण हुने गरी मूल्याङ्कनका विभिन्न विधि तथा साधनहरू निर्माण तथा प्रयोग गर्नुपर्दछ । मूल्याङ्कन प्रक्रियालाई सहजीकरण गर्नका लागि मूल्याङ्कनका आधारसमेत यस पाठ्यक्रममा समावेश गरिएको छ ।

यस पाठ्यक्रममा परिचय, विषयगत रूपमा अपेक्षित ज्ञान, सिप, अभिवृत्ति, मूल्य र कार्य तत्परतालाई समेटी त्यसको क्रियात्मक स्वरूपमा सक्षमता निर्धारण गरिएको छ । विषयगत विशिष्टपन र मौलिकतालाई समेटी सिकाइ सहजीकरणका विधि तथा प्रक्रिया प्रस्तुत गरिएको छ । यसमा आन्तरिक र र बाह्य मूल्याङ्कनका विधि तथा प्रक्रियासमेत उल्लेख गरी विद्यार्थी मूल्याङ्कनलाई व्यवस्थित गरिएको छ ।

२. तहगत सक्षमता

सामाजिक अध्ययन विषयको अध्ययनपश्चात् विद्यार्थीहरूमा निम्नानुसारका सक्षमता हासिल हुने छन् :

१. समाज तथा सामाजिकीकरण अवधारणाको विकास र व्यावहारिक अभ्यास

२. मानवसमाजको उद्भव र विकास सम्बद्ध विविधताको विश्लेषण

३. नेपाल र विश्वभूगोलका प्रमुख ऐतिहासिक घटनाहरूको प्रस्तुति

४. नेपालको सामाजिक तथा सांस्कृतिक मूल्य मान्यताहरूको पहिचान गर्दै समावेशीकरण र विविधताको सम्मान

५. नेपाल र विश्वको ऐतिहासिक विकासक्रमको प्रस्तुति

६. नागरिक सचेतना र वर्तमान संविधानका प्रमुख विशेषताहरूको विश्लेषण

७. जीवनोपयोगी शिक्षामा निर्णय प्रक्रिया, समस्या समाधान, सञ्चार, तनाव व्यवस्थापन र अन्तरवैयक्तिक सिप र सम्बन्धको प्रयोग र उपयोग

८. पारिस्थितिक पद्धति, जनसाङ्ख्यिक स्वरूप, बसाइँसराइको गतिशीलता, र यौन तथा प्रजनन शिक्षासम्बन्धी समीक्षात्मक विश्लेषण

३. कक्षागत सिकाइ उपलब्धि

कक्षा १२ को अन्त्यमा विद्यार्थीहरूमा निम्नअनुसारका सिकाइ उपलब्धिहरू हासिल हुने छन् :

एकाइ	विषयवस्तुको क्षेत्र	सिकाइ उपलब्धि
१.	समाज तथा सामाजिकीकरण	१.१ सामाजिक अध्ययन विषयको परिचय दिन १.२ सामाजिक अध्ययन विषयको महत्त्व र विकासक्रम बताउन १.३ सामाजिक अध्ययनका सिपहरू (बौद्धिक, सामाजिक सांस्कृतिक, सञ्चार र प्रविधि) को पहिचान गरी दैनिक जीवनमा प्रयोग गर्न १.४ समाज र समुदायको अवधारणा बताउँदै यसका विशेषताहरू चित्रण गर्न १.५ प्राविधिक तथा व्यावसायिक शिक्षाको समाजसँग रहेको सम्बन्ध पहिल्याउन १.६ सामाजिकीकरणको अवधारणा बताउन १.७ सामाजिकीकरणका तत्त्वहरूको सूची बनाई व्याख्या गर्न ।
२.	मानवसमाजको उद्भव र विकास	२.१ मानव समाजको उद्भव र विकास क्रम बताउन २.१.१ ढुङ्गे युगको संस्कृतिको विवेचना गर्न

		२.१.२ कृषि युगको सुरुआत र विकासक्रमको व्याख्या गर्न २.१.३ औद्योगिक युग र उत्तर आधुनिक युगको निर्माण र प्रभावको विश्लेषण गर्न २.२ सामाजिक विविधताको अर्थ बताउँदै यसका आयामहरूको विश्लेषण गर्न २.३ सिप र प्रविधिमा आधारित समाजका विशेषताहरू पत्ता लगाउन २.४ मानव समाजको विकासका विभिन्न चरणहरूसँग आजको मानव समाजको तुलना गर्न ।
३.	नेपाल र विश्व भूगोल	३.१ विश्व मानचित्रमा नेपालको अवस्थिति पत्ता लगाउन ३.२ नेपालको भौगोलिक विभाजन (धरातलीय स्वरूप, नदी, हावापानी) लाई नक्साको माध्ययमद्वारा देखाउन ३.३ प्रशासनिक आधारमा नेपालको विभाजन गरी नक्साद्वारा देखाउन ३.४ हावापानी तथा खेतीपातीका लागि नेपालमा पश्चिमी वायु र मनसुनी वायुको प्रभाव पत्ता लगाउन ३.५ नेपालको जनजीवनमा भौगोलिक विविधताले पार्ने प्रभावको विश्लेषण गर्न ३.६ नेपालका सन्दर्भमा निम्नलिखित प्राकृतिक स्रोतहरूको वर्तमान अवस्था, सम्भावना र उपयोगिताको विश्लेषण गर्न : भूमि, वन, खनिज, जलस्रोत, नदी, कुण्ड र तालहरू, सौन्दर्य र पर्यटन ३.७ अवस्थिति (ध्रुव, अक्षांश, देशान्तर र अन्तर्राष्ट्रिय तिथि रेखा) को आधारभूत अवधारणा बताउन ३.८ अक्षांश र देशान्तरका आधारमा समय र दुरीको गणना गर्न ३.९ महादेश र महासागरहरूको सामान्य परिचय दिन ३.१० भूकम्प, बाढी, पहिरो हिमपहिरो जस्ता विपद्को अवधारणा बताउँदै यसका कारण र परिणामहरूको विवेचना गर्न ३.११ माथि उल्लेखित विपद्बाट बँच्न अपनाइने सावधानीका उपायहरूको खोजी गर्न ३.१२ विपत् व्यवस्थापनमा स्थानीय साधन र सिपको प्रयोग गर्दै अरूलाई सहभागी हुन प्रेरित गर्न र आफू पनि सहभागी हुन
४.	नेपालको सामाजिकतथा	४.१ नेपालका मौलिक जातजाति, धर्म, संस्कृति, भाषाभाषी, पेसा, चाडपर्व, प्रथा, परम्परा, रहनसहन, मूल्य र मान्यताहरूको खोजी गर्न

	सांस्कृतिक मूल्य मान्यताहरू	४.२ नेपालीकला (वास्तुकला, चित्रकला, मूर्तिकला, र काष्ठकला) का विशेषता र महत्त्व बताउन ४.३ नेपालमा रहेका भौगोलिक, जातीय, धार्मिक, लैङ्गिक तथा यौनिक अल्पसङ्ख्यकहरूको पहिचान गर्दै राज्यका तर्फबाट उनिहरूका लागि व्यवस्था गरिएको सामाजिक सुरक्षाको व्यवस्था विश्लेषण गर्न ४.४ शारीरिक र मानसिक अपाङ्गता भएका व्यक्तिहरूले सामाजिक सुरक्षाका रूपमा प्राप्त गरेका सेवा सुविधाहरूको खोजी गर्न ४.५ ज्येष्ठ नागरिक र उनीहरू प्रतिको सम्मानका लागि राज्यबाट निर्धारण गरिएका नीतिको खोजी गर्दै आफू पनि ज्येष्ठ नागरिकको सम्मानमा लाग्न ४.६ नेपालमा सामाजिक सुरक्षासम्बन्धी प्रावधानको विश्लेषण गर्दै यसको व्यावहारिक अभ्यासमा देखिएका कठिनाइहरूको विवेचना गर्न ।
५.	नेपाल र विश्वको ऐतिहासिक विकासक्रम	५.१ किरातकाल, लिच्छविकाल र मध्यकाल (मल्लकाल) को सामाजिक, आर्थिक एवम् राजनीतिक अवस्था चित्रण गर्न ५.२ नेपालको आधुनिक इतिहासअन्तर्गत : ५.२.१ नेपाल एकीकरण अभियानको चर्चा गर्न ५.२.२ राणाशासन कालको सामाजिक र आर्थिक परिवर्तन पत्ता लगाउन ५.२.३ वि.सं. २००७ देखि २०१७ सालसम्मको राजनीतिक घटनाक्रमको वर्णन गर्न ५.२.४ वि.सं. २०१७-२०४६ सालसम्मको राजनीतिक घटनाक्रमको सूची बनाउन ५.२.५ वि.सं. २०४६ देखि हालसम्मको राजनीतिक घटनाक्रमहरूको चर्चा गर्न ५.३ औद्योगिक क्रान्ति र विश्वको आर्थिक सामाजिक क्षेत्रमा यसका प्रभावहरूको विश्लेषण गर्न ५.४ विश्वमा लोकतन्त्रको उदय, विकासक्रम र वर्तमान अवस्थाको विवेचना गर्न ।
६.	संविधान र नागरिक सचेतना	६.१ नेपालको संवैधानिक विकासक्रमको चर्चा गर्न ६.२ नेपालको संविधान २०७२ का प्रमुख राजनीतिक, कानुनी, आर्थिक र सांस्कृतिक विशेषताहरूको विश्लेषण गर्न । ६.३ नेपालका सन्दर्भमा वालिग मताधिकारको अवधारणा प्रष्ट्याउँदै सङ्घ,

		प्रदेश र स्थानीय तहको निर्वाचन प्रक्रियाबारे व्याख्या गर्न ६.४ नेपालको राष्ट्रिय सुरक्षाको अवधारणा बताउँदै नेपालमा राष्ट्रिय सुरक्षाको वर्तमान अवस्थाको विश्लेषण गर्न ६.५ नेपालमा रहेको प्राविधिक तथा व्यावसायिक शिक्षासम्बन्धी नीतिगत र संस्थागत व्यवस्थाको विवेचना गर्न ।
७.	जीवनोपयोगी सिप	७.१ जीवनोपयोगी सिपको व्याख्या गर्न र सामाजिक तथा पेसागत जीवनमा तिनको प्रयोग गर्न ७.२ सामाजिक अध्ययन र जीवनोपयोगी शिक्षामा निर्णय प्रक्रिया, समस्या समाधान, सञ्चार, तनाव व्यवस्थापन र अन्तरवैयक्तिक सिप र सम्बन्धको विश्लेषण गरी प्रयोग र प्रस्तुत गर्न
८.	वातावरण र जनसाङ्ख्यिकी	८.१ नेपालमापा रिस्थितिक प्रणाली र जैविक विविधताको अवस्थाको विवेचना गर्न ८.२ जलवायु परिवर्तनका कारण, असर र असर कम गर्ने उपायहरूको खोजी गर्न ८.३ दिगो विकासको अवधारणा उल्लेख गर्न ८.४ नेपालको जनसङ्ख्याको आकार, बनोट र वितरणको अवस्था पहिल्याउँदै तथ्याङ्कको खोजी, प्रस्तुति र विश्लेषणको प्रयोगात्मक अभ्यास गर्न ८.५ स्थानीय स्तरमा जन्म, मृत्यु र बसाइँसराइको अवस्थाको सर्वेक्षण गर्दै प्रतिवेदन तयार गर्न ८.६ नेपालमा बसाइँसराइको प्रवृत्ति, कारण र आर्थिक सामाजिक प्रभावको खोजी गर्न ८.७ नेपालमा सहरीकरणको मापदण्ड, विस्तार र प्रवृत्तिको चर्चा गर्न ८.८ नेपालमा जनसङ्ख्या व्यवस्थापनका उपायहरूको खोजी गर्न ८.९ किशोरावस्थामा हुने यौनआवेग र संवेगको पहिचान र व्यवस्थापन गर्ने उपयुक्त उपायहरूको खोजी र प्रयोग गर्न ।

४. विषयवस्तुको क्षेत्र र क्रम

क्र.स.	विषयक्षेत्र	विषयवस्तु (कक्षा १२)	कार्यघण्टा
१.	समाज तथा सामाजिकीकरण	१.१ सामाजिक अध्ययनको परिचय महत्व र विकासक्रम १.२ सामाजिक अध्ययनका सिपहरू (वौद्धिक, सामाजिक साँस्कृतिक, संचार र प्रविधि) १.३ समाज र समुदायको अवधारणा र विशेषताहरू १.४ प्राविधिक तथा व्यवसायिक शिक्षा र समाजबिचको सम्बन्ध १.५ सामाजिकीकरण अवधारणा, तत्त्वहरू १.६ सामाजिक परिवर्तन र प्रविधिको प्रभाव र प्रयोग १.७ सामाजिक अन्तरक्रिया अवधारणा र व्यावहारिक अभ्यास	१२
२.	मानव समाजको उद्भव र विकास	२.१ मानव जातिको उद्भव र विकास २.१.१ ढुङ्गे युगको संस्कृति २.१.२ कृषि युगको सुरुआत र विकास २.१.३ औद्योगिक युग र उत्तर आधुनिक युगकोनिर्माण र प्रभाव २.२ सामाजिक विविधताको अर्थ रआयामहरू २.३ सिप र प्रविधिमा आधारित समाज	८
३.	नेपाल र विश्व भूगोल	३.१ नेपालको भूगोल ३.१.१ विश्व मानचित्रमा नेपाल ३.१.२ नेपालको भौगोलिक विभाजन (धरातलिय स्वरूप, नदी, हावापानी) ३.१.३ नेपालमा पश्चिमी वायु र मनसुनी वायुको प्रभाव ३.१.४ नेपालको भौगोलिक विविधताको जनजीवनमा प्रभाव ३.१.५ प्रशासनिक आधारमा नेपालको विभाजन ३.१.६ प्राकृतिक स्रोतहरू : भूमि, वन, खनिज, जलश्रोत, नदी, कुण्ड र तालहरू, सौन्दर्य र पर्यटन	१६

		३.२ विश्वको भूगोल ३.२.१ अवस्थिति (ध्रुव, अक्षांश, देशान्तर, अन्तर्राष्ट्रिय तिथि रेखा) ३.२.२ महादेश र महासागरहरूको सामान्य परिचय ३.२.३ अक्षांश र देशान्तरका आधारमा समय र दुरीको गणना ३.३ विपत् व्यवस्थापन : नेपालमा विद्यमान प्रयास र अभ्यास ३.३.१ भूकम्प, बाढी, पहिरो हिमपहिरो (अवधारणा, कारण, परिणाम र सावधानीका उपाय) ३.३.२ विपत् व्यवस्थापनमा स्थानीय सिपको प्रयोग र जनसहभागिता	
४.	नेपालको सामाजिक तथा सांस्कृतिक मूल्य मान्यताहरू	४.१ नेपालको सामाजिक एवम् सांस्कृतिक अवस्था ४.१.१ जातजाति, धर्म, संस्कृति, भाषाभा षी, पेसा, चाडपर्व,प्रथा, परम्परा, रहनसहन, मूल्य र मान्यता ४.१.२ नेपालीकला (वास्तुकला, चित्रकला, मूर्तिकला, र काष्ठकला) विशेषता र महत्त्व ४.२ नेपालमा समावेशीकरण परिचय र प्रावधान (भौगोलिक, जातीय, धार्मिक, लैङ्गिक तथा यौनिक अल्पसङ्ख्यक, अपाङ्गता) ४.३ जेष्ठ नागरिक र उनीहरूको सम्मान ४.४ नेपालमा सामाजिक सुरक्षासम्बन्धी प्रावधान र यसको अभ्यास	१२
५.	नेपाल र विश्वको ऐतिहासिक विकासक्रम	५.१ नेपालको इतिहास ५.१.१ किरातकाल, लिच्छविकाल र मध्यकाल (मल्लकाल) (सामाजिक, आर्थिक एवम् राजनीतिक अवस्था) ५.१.२ नेपालको आधुनिक इतिहास : ५.१.२.१ नेपाल एकीकरण अभियान ५.१.२.२ राणाशासन (सामाजिक, आर्थिक परिवर्तन) ५.१.२.३ वि.सं. २००७ देखि २०१७ सालसम्मको राजनीतिक	१४

		घटनाक्रम ५.१.२.४ वि.सं. २०१७-२०४६ सालसम्मको राजनीतिक घटनाक्रम ५.१.२.५ वि.सं. २०४६ देखि हालसम्मको राजनीतिक घटनाक्रम ५.२ विश्वको इतिहास ५.२.१ औद्योगिक क्रान्ति र यसका प्रभाव ५.२.२ विश्वमा लोकतन्त्रको उदय, विकासक्रम र वर्तमान अवस्था	
६.	संविधान र नागरिक सचेतना	६.१ संविधान र नागरिक सचेतना ६.१.१ नेपालको संवैधानिक विकासक्रम र नेपालको संविधान २०७२ का प्रमुख विशेषताहरू (राजनीतिक, कानुनी, आर्थिक र सांस्कृतिक) ६.१.२ निर्वाचन प्रक्रिया (सङ्घ, प्रदेश र स्थानीय तह) र बालिग मताधिकार ६.१.३ नेपालको राष्ट्रिय सुरक्षाको अवधारणा र वर्तमान अवस्था ६.१.४ प्राविधिक तथा व्यवसायिक शिक्षासम्बन्धी नीतिगत र संस्थागत व्यवस्था	१२
७.	जीवनोपयोगी सिप	७.१ जीवनपयोगी सिपको परिचय र यसको वर्गीकरण ७.२ निर्णय प्रक्रिया ७.२.१ निर्णयको परिचय र प्रकार ७.२.२ निर्णय प्रक्रियाका चरण, प्रयोग र अभ्यास ७.२.३ निर्णयमा अनिर्णित हुने अवस्थाको पहिचान ७.३ समस्या समाधान ७.३.१ समस्याको परिचय र पहिचान ७.३.२ समस्या समाधानका चरण ७.३.३ समस्या समाधानको व्यावहारिक अभ्यास ७.४ सञ्चार ७.४.१ सञ्चार सिपको पहिचान र प्रकार ७.४.२ सञ्चारका अवरोधहरू	१४

		७.४.३ प्रभावकारी सञ्चार र प्रभावकारी सम्बन्ध ७.४.४ प्रभावकारी सञ्चारका माध्यम र अभ्यास ७.४.५ सामाजिक सञ्जालको सदुपयोग ७.५ तनाव व्यवस्थापन ७.५.१ तनावको अर्थ, सिर्जित अवस्था र असर ७.५.२ तनाव व्यवस्थापनका उपायहरू : समर्पण, प्रतिरोध र सम्झौता तथा तिनका व्याहारिक अभ्यास ७.५.३ तनाव व्यवस्थापनका रणनीति ७.५.४ द्वन्द्व, तनाव, द्वन्द्व रूपान्तरण र व्यवस्थापनको प्रक्रिया र अभ्यास ७.५.५ तनाव व्यवस्थापनमा मनोसामाजिक परामर्श, योग र ध्यानको प्रयोग ७.६ अन्तरवैयक्तिक सिप र सम्बन्ध ७.६.१ अन्तरवैयक्तिक सिपको अर्थ र महत्त्व ७.६.२ अन्तरवैयक्तिक सम्बन्ध सुधारका उपाय ७.६.३ अन्तरवैयक्तिक सम्बन्ध र सामाजिक सञ्जाल ७.६.४ असल नेतृत्वका लागि अन्तरवैयक्तिक सम्बन्ध व्यवस्थापन ७.६.५ टोलीकार्य र नेतृत्व विकास	
८.	वातावरण र जनसाङ्ख्यिकी	८.१ पारिस्थितिक पद्धति र वातावरण ८.१.१ पारिस्थितिक प्रणाली र जैविक विविधता, ८.१.२ जलवायु परिवर्तन ८.१.३ दिगो विकास ८.२ जनसाङ्ख्यिकी र नेपालको जनसङ्ख्या ८.२.१ नेपालको जनसङ्ख्याको आकार, बनोट र वितरण ८.२.२ जनसाङ्ख्यिक तत्त्वहरू: जन्म, मृत्यु र बसाइँसराइ ८.२.३ नेपालमा बसाइँसराइको प्रवृत्ति, कारण र यसको आर्थिक सामाजिक प्रभाव ८.२.४ नेपालमा सहरीकरणको मापदण्ड, विस्तार र प्रवृत्ति ८.२.५ नेपालमा जनसङ्ख्या व्यवस्थापनका उपायहरू ८.३ यौन तथा प्रजनन् शिक्षा	८

		८.३.१ किशोर किशोरीहरूका लागि यौनिकता शिक्षाः यौन आवेग र संवेगको पहिचान र व्यवस्थापन	
		जम्मा	**९६**

५. प्रयोगात्मक तथा परियोजना कार्यमा समावेश गर्न सकिने केही क्रियाकलापहरू

एकाइ	विषयवस्तुको क्षेत्र	कार्य घण्टा	नमुना क्रियाकलाप
१.	समाज तथा सामाजिकीकरण	२	• तपाईं बसोबास गर्ने ठाउँमा कक्षा ८, ९ र १० मा अध्ययनरत कुनै पनि भाइबहिनीका १० जना अविभावकहरूलाई भेटी सामाजिक सञ्जालको प्रयोगका कारण उनीहरूका छोराछोरीको सामाजिकीकरण र अध्ययनमा पारेको प्रभावका बारेमा सोधखोज गरी आएको प्रतिक्रियालाई टिपोट गर्नुहोस् र सो प्रतिक्रियाका आधारमा एउटा प्रतिवेदन तयार गर्नुहोस् ।
२.	मानव समाजको उद्भव र विकास	२	• तपाईं बसोबास गरेको समुदायमा आजसम्म पनि के कस्ता परम्परागत सिप तथा प्रविधिहरू प्रयोग भइरहेका रहेछन् ? खोजी गरी प्रतिवेदन तयार गर्नुहोस् । प्रतिवेदनमा सम्भव भएसम्म हरेक सिप तथा प्रविधिको फोटो, परिचय, निर्माण विधि र प्रयोगको क्षेत्र (कृषि, उद्योग, पर्यटन आदि) समेत समेट्नुहोस् ।)
३.	नेपाल र विश्व भूगोल	३	• कक्षाका सबै विद्यार्थीलाई पाँच समूहमा विभाजन गर्नुहोस् । हरेक समूहले तल दिइएका एक/एकओटा काम गर्नुहोस् : हरेक समूहले एउटा ठुलो प्लाइउडको व्यवस्था गर्नुहोस् । सो प्लाइउडमा सेतो रङको चार्टपेपर टाँस्नुहोस् । अब ग्राफ विधिको प्रयोग गरी ६०×३६ आकारमा नेपालको नक्सा बनाउनुहोस् । सो नक्सामा निम्नानुसार विवरण सङ्केतका आधारमा देखाउनुहोस् । समूह १ : नेपालको धरातलीय स्वरूप समूह २ : मुख्य हावापानी क्षेत्र समूह ३ : मुख्य नदी क्षेत्र (कोशी, गण्डकी र कर्णाली)

<table>
<tr><td></td><td></td><td></td><td>समूह ४ : भौगोलिक विभाजन अनुसार मुख्य पेसाका क्षेत्रहरू

समूह ५ : नेपालको राजनीतिक र प्रशासनिक विभाजन

• तपाईं बसोबास गर्ने ठाउँका स्थानीय ज्येष्ठ नागरिकहरूलाई भेटी सो स्थानमा विगतमा आएका विभिन्न प्राकृतिक विपत्हरूका बारेमा सोधखोज गरी ती विपत् व्यवस्थापन कसरी भएका रहेछन् भन्ने तथ्य समेत समेटेर एउटा प्रतिवेदन तयार गर्नुहोस् ।</td></tr>
<tr><td>४</td><td>नेपालको सामाजिकतथा सांस्कृतिक मूल्य मान्यताहरू</td><td>३</td><td>• तपाईं बसोवास गरेको वडाका केही ज्येष्ठ नागरिकलाई भेटी उहाँहरूले सामाजिक सुरक्षाबापत राज्यका तर्फबाट प्राप्त गरिरहनु भएका सेवा सुविधाहरूका बारेमा सोधखोज गर्नुहोस् र प्राप्त प्रतिक्रियाहरूलाई टिपोट गर्दै जानुहोस् । त्यस्तै उहाँहरूले सामाजिक सुरक्षाबापत राज्यबाट अपेक्षा गर्नुभएको थप सेवा सुविधाहरूका बारेमा समेत सोधखोज गरी प्रतिवेदन तयार गर्नुहोस् ।</td></tr>
<tr><td>५.</td><td>नेपाल र विश्वको ऐतिहासिक विकासक्रम</td><td>२</td><td>• तपाईंको समुदायमा भएका सबैभन्दा ज्येष्ठ नागरिकलाई भेटी उहाँ तपाईंको उमेरको हुँदा र अहिले तल दिइएका क्षेत्रमा के कस्तो अवस्था थियो, सोध्नुहोस् र आजको अवस्थासँग तुलना गर्नुहोस् ।
<table>
<tr><th>क्षेत्र</th><th>पहिले</th><th>अहिले</th></tr>
<tr><td>आम्दानीको स्रोतका क्षेत्र</td><td></td><td></td></tr>
<tr><td>खना</td><td></td><td></td></tr>
<tr><td>कपडा</td><td></td><td></td></tr>
<tr><td>यातायात</td><td></td><td></td></tr>
<tr><td>सञ्चार</td><td></td><td></td></tr>
<tr><td>वरपरको पर्यावरण</td><td></td><td></td></tr>
</table>
• आफ्ना अविभावकहरूसँग सोधखोज गरेर तपाईंसहित सात पुस्ता समेटेर आफ्नो वंश वृक्ष तयार गर्नुहोस् ।</td></tr>
<tr><td>६.</td><td>संविधान र नागरिक सचेतना</td><td>२</td><td>• तपाईं बसोबास गर्ने जिल्लाबाट प्रतिनिधि सभा, प्रदेश सभा र स्थानीय तहमा प्रतिनिधित्व गर्ने प्रतिनिधिहरूको विवरण तल दिइएको तालिकामा भर्नुहोस् :</td></tr>
</table>

प्रतिनिधि सभा तथा प्रदेश सभा

प्रदेश :..... जिल्ला :..... निर्वाचन क्षेत्र सङ्ख्या :....

क्षेत्र न.	निर्वाचित प्रतिनिधिको नाम	राजनीतिक दल
प्रतिनिधि सभा	१.	
क		
ख		
प्रतिनिधि सभा	२.	
क		
ख		

स्थानीय तह

जिल्ला : ..... स्थानीय तहको नाम : .....

पद	प्रतिनिधीको नाम	राजनीतिक दल	ठेगाना
प्रमुख			
उपप्रमुख			
वडा अध्यक्ष			
वडा सदस्य १			
वडा सदस्य २			
वडा सदस्य ३			
वडा सदस्य४			

७.	जीवनोपयोगी सिप	६	• तपाईंको एक मिल्ने साथीले धूमपान गर्न लागेको छ । उसले तपाईंलाई समेत धूमपान गर्न कर गरिरहेको छ तर तपाईंलाई उसको यो बानी मन पर्दैन । आफूभन्दा बलियो र भिन्न सामाजिक परिवेशबाट आएकाले तपाईं उसलाई केही भनिहाल्न पनि सक्नुहुन्न । अब तपाईं यस्तो कुलतबाट टाढा बस्न के निर्णय गर्नुहुन्छ अनि त्यो निर्णय कसरी कार्यान्वयन गर्नुहुन्छ ? प्रतिवेदन तयार पारी प्रस्तुत गर्नुहोस् । • तलको घटना अध्ययन गर्नुहोस् र दिइएका प्रश्नका आधारमा घटना विश्लेषण गरी प्रतिवेदन तयार गर्नुहोस् :

			● तपाईंको एक साथी साथीहरूको सङ्गतमा परेर लागुपदार्थको दुर्व्यसनमा फसेको छ । ऊ परिवारलाई यो कुरा भन्न सकिरहेको छैन तर घरमा सामानहरू हराउने, पैसा हराउने समस्याले अभिभावकहरू हैरान छन् । उसको समूहका साथीहरूबाट पनि ऊ खतरामा छ भने पुलिस प्रशासनबाट पनि पक्राउ पर्ने सम्भावना छ । अभिभावकहरूमा छोरामा आएको परिवर्तनमा थोरै आशङ्का रहे पनि के गर्ने नगर्ने केही गर्न सकिरहेका छैनन् । अब सोच्नुहोस् (क) माथिका घटनाको मुख्य समस्या केसँग सम्बन्धित छ ? (ख) समस्याका कारणहरू के के हुन सक्छन् ? (ग) समस्या समाधानका उपायहरू के के हुन सक्छन् ? ● तपाईंको समुदायमा रहेको कुनै एक समस्या पहिचान गर्नुहोस् । यो समस्या कसरी समाधान गर्न सकिन्छ ? समस्या समाधानका लागि योजना तयार पार्ने, समाधानको प्रयास गर्ने र समाधानका लागि आफूले गरेका प्रयास र त्यसको प्रगतिसम्बन्धी सम्पूर्ण योजना तयार पारी प्रस्तुत गर्नुहोस् । ● तपाईंको कक्षाको एक साथीको एउटा सकारात्मक र एउटा सुधारापेक्षी व्यवहार सङ्केत गरी सङ्केत गरिएको व्यवहार सुधारका लागि साथीले गर्नुपर्ने कार्यकलापको सूची बनाई सकारात्मक कार्यलाई यथावत् राख्न र सुधारापेक्षी व्यवहारलाई सुधार गर्न सुझाव दिनुहोस् र साथीले उसको सूचीअनुसारको व्यवहार पालन गर ेनगरेको अवलोकन गरी टिपोट तयार गर्नुहोस् अनि साथीको व्यवहारबाट आफूले समेत सुधार गर्नुपर्ने पक्ष समेत टिपोट गर्नुहोस् । ● पछिल्लो १५ दिनमा आफूले सामना गर्नुपरेको तनाव उल्लेख गरी उक्त तनावका कारण र त्यसलाई समाधान गर्न आफूले गरेका प्रयास उल्लेख गरी प्रस्तुत गर्नुहोस् ।
८.	वातावरण र जनसाङ्ख्यिकी	४	● स्थानीय पालिका कार्यालयमा गएर आफ्नो पालिकाको जन्म, मृत्यु र बसाइँसराइसम्बन्धी तथ्याङ्कहरूको खोजी गर्नुहोस् । प्राप्त तथ्याङ्कलाई तालिका र स्तम्भचित्रमा देखाउँदै प्राप्त आँकडाको विश्लेषण गर्नुहोस् । (पालिका कार्यालयले स्थानीय स्तरमा गर्ने विभिन्न प्रकारका सर्वेक्षण र अध्ययनका बारेमा सोधखोज गरी सो कार्यमा

			तपाईं आफू पनि संलग्न हुन सक्नुहुन्छ ।) • नजिकैको सहरमा बसोबास गर्दै गरेका केही व्यक्तिहरूलाई भेटी सहरीकरणका कारणले उनीहरूले भोगेका समस्या तथा कठिनाइहरूका बारेमा सोधखोज गरी 'सहरीकरणका कारणले निम्तिएका समस्या र समाधानका उपायहरू' शीर्षकमा एउटा प्रतिवेदन तयार गर्नुहोस् । • विषय शिक्षकको सहयोगमा कक्षामा पढ्ने पाँच/पाँच जना साथीहरूको समूह बनाउनुहोस् । किशोरावस्थामा आफुमा के कस्ता यौन आवेग र संवेगहरू देखिएका छन्, साथीहरूबिच छलफल गर्नुहोस् र प्राप्त बुँदाहरूलाई टिपोट गर्दै जानुहोस् । ती आवेग र संवेगहरूलाई के कसरी व्यवस्थापन गर्न सकिन्छ भन्ने बारेमा पनि सहपाठी साथीहरूबिच छलफल गर्नुहोस् । प्राप्त भएका बुँदाहरूलाई माथि जसरी नै टिपोट गर्दै जानुहोस् । प्राप्त भएका बुँदाहरूका आधारमा 'किशोरावस्थामा हुने यौन आवेग र संवेगको पहिचान र व्यवस्थापनका उपायहरू' शीर्षकमा एउटा प्रतिवेदन तयार गर्नुहोस् । आफ्नो समूहको प्रतिवेदनसँग अन्य समूहको प्रतिवेदन के कति मिल्छ, तुलनासमेत गर्नुहोस् ।
	जम्मा	**२४**	

६. सिकाइ सहजीकरण प्रक्रिया

सामाजिक अध्ययन विषयले विद्यार्थीहरूलाई राष्ट्र र राष्ट्रियताप्रति समर्पित, नागरिक मूल्य मान्यताप्रति सचेत र समसामयिक परिवेशको विश्लेषण र समालोचनात्मक दृष्टिकोणसहितको नागरिक तयार गर्ने उद्देश्य राखेको छ । यस विषयको पाठ्यक्रम सामाजिक जीवनसँग सम्बन्धित विभिन्न क्षेत्रहरूलाई समेटेर एकीकृत रूपमा तयार गरिएको छ । यसमा उल्लेख गरिएका विषयवस्तुहरूको अध्ययन अध्यापन गराउँदा सबै क्षेत्रलाई उत्तिकै महत्त्व दिनुपर्ने हुन्छ । सम्बन्धित विषयवस्तुको एकीकृत रूपमा सहजीकरण गराई विषयवस्तुको ज्ञान, सिप र धारणाको विकास गराउनुपर्छ । विद्यार्थीहरूमा सैद्धान्तिक र व्यावहारिक दुवै पक्षको विकास गराई सकारात्मक व्यवहारको जगेर्ना गर्नु यस विषयको मुख्य ध्येय हो ।

विद्यार्थीमा समालोचनात्मक तथा सकारात्मक सोचको विकास, प्रतिभा प्रस्फुटन, सिर्जनात्मक सिपको विकास र विविध प्रकारका सामाजिक सिपको विकास गरी व्यवहारमा सुधार गर्दै

समाजको नेतृत्व गर्न सक्ने क्षमताको विकास गराउने जस्ता मूलभूत उद्देश्यहरू यस विषयले राखेको छ । सामाजिक अध्ययनका विषयवस्तुको व्यावहारिक ज्ञान दिनका लागि कक्षाभित्र वा बाहिर आआफ्नो कक्षाकोठा, विद्यालय, परिवार, टोल, विभिन्न समूह, समुदायलगायत स्थानीय सरकारसँग सम्बन्धित क्रियाकलापहरू गराउनुपर्ने छ । विषयवस्तुलाई जस्ताको तस्तै कण्ठ गराउने शिक्षण पद्धतिलाई निरुत्साहन गरी विद्यार्थीहरूलाई आआफ्ना समुदायमा खोज गरी सिर्जनात्मक प्रतिभाको विकास गर्न प्रोत्साहन गर्नुपर्ने छ ।, प्रतिवेदन, रेखाचित्र, वृत्तचित्र, स्तम्भ चित्र, तालिका, तस्बिर, नक्सा जस्ता सिर्जनशील कार्यमार्फत आवश्यक ज्ञान, सिप र अभिवृत्ति विकास गराउँदै सिर्जनशीलताको विकास गराउने लक्ष्य राखेको छ ।

यी सिपहरूको विकासका लागि सबै विद्यार्थीहरूलाई एकै खालको सहजीकरणले सम्भव नहुन पनि सक्छ । त्यसैले उनीहरूलाई बहुबौद्धिकताको सिद्धान्तअनुरूप रुचि र क्षमताअनुसारका ज्ञान र सिप एवम् मूल्यहरूको विकास गर्न क्रियाकलापमा विविधता ल्याउनुपर्छ । यसका निम्ति योजनाबद्ध सिकाइ सहजीकरणको ठुलो भूमिका रहन्छ । विद्यार्थीहरूलाई "गर र सिक" भन्ने धारणाको अभिवृद्धि गराउनु सामाजिक अध्ययन विषयको मूल लक्ष्य हो । किशोर किशोरी आफैँले गरेर सिकेका कुरामा विश्वास गर्छन् । मनमा विश्वास जागेपछि उक्त सिकाइले व्यवहारमा सुधार ल्याउँछ । त्यसैले सामाजिक अध्ययन विषयमा सिकाइ सहजीकरण गर्दा विभिन्न प्रकारका विद्यार्थीकेन्द्रित शिक्षण विधिहरू प्रयोग गर्नुपर्छ । जस्तै :

(क) प्रश्नोत्तर

(ख) प्रदर्शन

(ग) समस्या समाधान

(घ) छलफल

(ङ) अवलोकन

(च) सोधखोज

(छ) अभिनय

(ज) परियोजना

(झ) प्रयोग

(ञ) घटना अध्ययन

(ट) समालोचनात्मक चिन्तन र

(ठ) सामुदायिक कार्य

यी विधिहरू नमुना मात्र हुन् । स्थानीय परिवेश, विषयवस्तुको प्रकृति र स्वरूपका आधारमा सिकाइ सहजीकरणमा विविधता ल्याउन सकिने छ । शिक्षकले सिकाइ सहजीकरण गर्दा विद्यार्थीको उमेर, तह, रुचि, बहुबौद्धिकता, मनोविज्ञान, सामाजिक पृष्ठभूमि, विद्यार्थी सङ्ख्या, शैक्षिक सामग्रीको उपलब्धता आदि समेतलाई ध्यान दिनुपर्ने हुन्छ । सहजीकरण गर्दा विद्यार्थीहरूको सहभागिता एवम् सामूहिक तथा सहयोगात्मक सिकाइलाई प्रोत्साहन गर्नुपर्छ । विद्यार्थीलाई समस्या समाधान गर्न गाह्रो वा अप्ठ्यारो परेको अवस्थामा उनीहरूका कमी कमजोरीलाई राम्ररी केलाई शिक्षकद्वारा समस्या समाधानमा सहयोग गर्नुपर्छ । विद्यार्थीहरू सिर्जना र प्रतिभाका भण्डार हुन् । त्यसैले उनीहरूका प्रतिभा प्रष्फुटनका लागि उपयुक्त वातावरण सिर्जना गर्नुपर्छ । शिक्षकले एउटा सहजकर्ताका रूपमा विद्यार्थीहरूलाई सही बाटो देखाउन सहयोग पुऱ्याउनुपर्छ । उल्लिखित विधिहरूका अतिरिक्त कथाकथन, मन्थन, कार्यशाला विधि, प्रवचन विधि, सर्वे जस्ता विधिहरू पनि आवश्यकताअनुसार प्रयोग गर्नुपर्छ । सामाजिक अध्ययन विषय शिक्षण गर्दा सूचना प्रविधिको समेत सहयोग लिएर सिक्न सक्ने वातावरण तयार गर्नुपर्छ ।

७. विद्यार्थी मूल्याङ्कन प्रक्रिया

पाठ्यक्रमले निर्धारण गरेका उद्देश्यअनुरूप विद्यार्थीहरूले ज्ञान, सिप तथा अभिवृत्ति प्राप्त गर्न सके सकेनन् भन्ने कुरा पत्तालगाउने महत्त्वपूर्ण साधन मूल्याङ्कन हो । विद्यार्थीहरूको मूल्याङ्कन गर्दा विद्यार्थीहरूले अध्ययन गरेका विषयवस्तु व्यवहारमा प्रयोग गर्न सक्छन् सक्दैनन् भनी अध्ययन गर्नुपर्छ । यसका लागि आन्तरिक मूल्याङ्कनका लागि विभिन्न साधन र विधिहरूको सञ्चयिका अग्रिम रूपमा शिक्षकले तयार पारी विद्यार्थीहरूलाई उपलब्ध गराउनुपर्छ । यस विषयको पाठ्यक्रममा समावेश गरिएका तहगत सक्षमताहरू, कक्षागत सिकाइ उपलब्धिहरू र तिनका विषयवस्तु, सोसँग सम्बन्धित सिप, सिकाइ सहभागिता र सिकाइ सक्रियताका आधारमा विद्यार्थीहरूको सिकाइको मूल्याङ्कन गर्नुपर्दछ । यस्तो मूल्याङ्कन शिक्षण सिकाइ क्रियाकलापकै अभिन्न अङ्गका रूपमा सञ्चालन गरी विद्यार्थीको सिकाइ सुधारमा केन्द्रित हुनुपर्दछ ।

विद्यार्थीहरूको मूल्याङ्कन निर्माणात्मक र निर्णयात्मक दुवै प्रयोजनका लागि सञ्चालन गरिने छ । विद्यार्थीको निर्णयात्मक मूल्याङ्कनका लागि मूल्याङ्कनको कुल भारमध्ये २५ प्रतिशत आन्तरिक र ७५ प्रतिशत बाह्य मूल्याङ्कनबाट हुने छ । यसका लागि निर्माणात्मक मूल्याङ्कनको निर्धारित अभिलेखका आधारमा मूल्याङ्कनको कुल अङ्कको २५ प्रतिशत

आन्तरिक मूल्याङ्कनका रूपमा र ७५ प्रतिशत बाह्य परीक्षाबाट समावेश गरी विद्यार्थीको सिकाइस्तर निर्धारण गरिन्छ ।

(क) आन्तरिक मूल्याङ्कन

आन्तरिक वा प्रयोगात्मक मूल्याङ्कनका लागि प्रत्येक विद्यार्थीहरूको कार्य सञ्चयिका फाइल बनाई सोका आधारमा उनीहरूले गरेका कार्य र उनीहरूमा आएको व्यवहार परिवर्तनका अभिलेख राखी सोका आधारमा अङ्क प्रदान गर्नुपर्दछ । सामाजिक अध्ययन विषय सिकाइका क्रममा कक्षाकोठामा कक्षागत शिक्षण सिकाइको अभिन्न अङ्गका रूपमा गृहकार्य, कक्षाकार्य, परियोजना कार्य, सामुदायिक कार्य, सह/अतिरिक्त क्रियाकलाप, एकाइ परीक्षा, मासिक परीक्षा जस्ता मूल्याङ्कन साधनहरूको प्रयोग गर्न सकिने छ । यस्तो मूल्याङ्कनका लागि विद्यार्थीको अभिलेख राखी त्यही अभिलेखका आधारमा सिकाइस्तर निर्धारण गर्न सकिन्छ । आवश्यकतानुसार उपचारात्मक शिक्षण सिकाइ क्रियाकलाप सञ्चालन गर्नुपर्छ । विशेष सिकाइ आवश्यकता भएका विद्यार्थीका लागि विषय शिक्षकले नै उपयुक्त प्रक्रिया अपनाई मूल्याङ्कन गर्नुपर्ने छ । यस विषयमा निर्माणात्मक मूल्याङ्कन प्रक्रियाको महत्त्वपूर्ण भूमिका रहेको हुन्छ । विद्यार्थीहरूले के कति सिके भन्ने कुरा पत्तालगाई नसिकेको भए कारण पहिचान गरी पुनः सिकाइनुपर्छ । आन्तरिक मूल्याङ्कनको भार २५% छुट्टाइएको छ । यस विषयको आन्तरिक मूल्याङ्कनमा कक्षा सहभागिता, सकारात्मक व्यवहार प्रयोगात्मक तथा परियोजना कार्य, आन्तरिक परीक्षाबाट प्राप्त विद्यार्थीको सिकाइ उपलब्धिलाई समेटिनु पर्दछ ।

यस खण्डको मूल्याङ्कन विद्यार्थीले व्यक्तिगत तथा समूह कार्य तथा परियोजनाको गुणस्तरको आधारमा विद्यालय तहमा गठन गरिने मूल्याङ्कन समितिले गर्ने छ भने तोकिएको निकायबाट यसको प्राविधिक परीक्षण हुने छ । आन्तरिक मूल्याङ्कनका आधारहरू र अङ्क विभाजन निम्नानुसार हुने छ :

आन्तरिक मूल्याङ्कनको विस्तृतीकरण

क्र.स.	क्षेत्र	परीक्षण गर्ने पक्ष	अङ्कभार	मूल्याङ्कनका आधार
१.	सिकाइ सहभागिता	सिकाइ सहभागिता	३	सक्रिय सिकाइका लागि दैनिक कक्षा उपस्थिति, व्यक्तिगत, समूहगत र कक्षागत सिकाइ सहभागिता
२	सकारात्मक व्यवहार तथा	सहयोग, सम्बन्ध, समन्वय,	४	• शिक्षक, साथी, अपाङ्गता भएका, जेष्ठ नागरिक, श्रमिकप्रति देखाउने व्यवहार, सहयोग, सहानुभूति, • सामुदायिक कार्यमा देखाएको उत्सुकता

	व्यवहार परिवर्तन	नेतृत्व, सहभागिता, ग्रहणशीलता		• नेतृत्व सिपमा आएको परिवर्तन • अरुका अनुकरणीय, असल व्यवहार ग्रहण
३	प्रयोगात्मक तथा परियोजना कार्य	प्रयोगात्मक तथा परियोजना कार्य	१२	प्रत्येक एकाइबाट कम्तीमा एउटा परियोजना कार्य वा सामुदायिक कार्य वा क्षेत्र भ्रमणमा सहभागी गराउने, विद्यार्थीको सहभागिता, सक्रियता, योजना निर्माण, अवलोकन, अन्तर्वार्ता, तथ्याङ्क सङ्कलन, प्रतिवेदनतयारी र प्रस्तुतीकरणलाई आधारमानी सामूहिक वा व्यक्तिगतरूपमा मूल्याङ्कन गर्ने
४	विषयगत मूल्याङ्कन	त्रैमासिक परीक्षा	५	त्रैमासिक परीक्षाहरूको मूल्याङ्कनका अभिलेख
		जम्मा	**२४**	

द्रष्टव्य : आन्तरिक मूल्याङ्कनका आधारहरूको विस्तृत विवरण आन्तरिक मूल्याङ्कन कार्यविधिमा तोकिएको आधारमा हुने छ ।

(ख) बाह्य मूल्याङ्कन

यस विषयको कुल भारमध्ये ७५ प्रतिशत भार बाह्य मूल्याङ्कनमार्फत् हुने छ । संज्ञान क्षेत्रका विभिन्न तहहरू विशेष गरी ज्ञान, सिप र प्रयोग तहमा पर्ने गरी अति छोटो उत्तर आउने प्रश्न, छोटो उत्तर आउने प्रश्न र लामो उत्तर आउने प्रश्न गरी तीन किसिमका प्रश्नहरू सोधिने छ । लामो उत्तर आउने प्रश्न समस्या समधान र विश्लेषण गर्ने खालको हुने छ । ती प्रश्नमा विद्यार्थीले दिएको जवाफको आधारमा उनीहरूको मूल्याङ्कन गरिने छ । प्रश्नहरू सैद्धान्तिक ज्ञानभन्दा पनि व्यावहारिक समस्याहरू समाधानमा जोड दिने खालका हुने छन् । मूल्याङ्कनलाई वस्तुगत बनाउन प्रश्नहरूलाई विशिष्ट बनाइने छ । बाह्य मूल्याङ्कनका लागि प्रश्नहरू पाठ्यक्रम विकास केन्द्रले तयार गरेको विशिष्टिकरण तालिकाअनुसार तयार गर्नुपर्ने छ ।

सैद्धान्तिक मूल्याङ्कन

विशिष्टीकरण तालिका, २०७८

कक्षा १२

विषय : सामाजिक अध्ययन **पूर्णाङ्कः ७५** **समयः २ घण्टा १५ मिनेट**

प्रश्न योजना तथा अङ्कभार वितरण

एकाइ	क्षेत्र/इकाइ	पाठ्यभार	ज्ञान १७ प्रतिशत			बोध २९ प्रतिशत			प्रयोग तथा सिप २७ प्रतिशत			उच्चदक्षता २७ प्रतिशत			जम्मा प्रश्नसङ्ख्या			जम्मा अङ्कभार		
			अति छोटो	छोटो	लामो	अति छोटो	छोटो	लामो	अति छोटो	छोटो	लामो	अति छोटो	छोटो	लामो	अति छोटो	छोटो	लामो	अति छोटो	छोटो	लामो
१	समाज तथा सामाजिकीकरण	१२	१	१				१			१				१	१	२	१	५	१६
२	मानवसमाजको उद्भव र विकास	८					१									१			५	
३	नेपाल र विश्व भूगोल	१६				१			१	१					२	१		२	५	
४	नेपालको सामाजिकतथा सांस्कृतिक मूल्य मान्यताहरू	१२	१	१								१			२	१		२	५	
५	नेपाल र विश्वको ऐतिहासिक विकासक्रम	१४	१			१	१								२	१		२	५	
६	संविधान र नागरिक सचेतना	१२										१	१	१	१	१	१	१	५	८
७	जीवनोपयोगी शिक्षा	१२				१			१	१					२	१		२	५	
८	वातावरण र जनसाङ्ख्यिकी	१०				१							१		१	१		१	५	
	जम्मा	**९६**	**३**	**२**		**४**	**२**	**१**	**२**	**२**	**१**	**२**	**२**	**१**	**११**	**८**	**३**	**११**	**४०**	**२४**

प्रश्नका प्रकारहरू

प्रश्नका प्रकारहरू	सोधिने सङ्ख्या	समय विभाजन (मिनेट)	पूर्णाङ्क
अति छोटो प्रश्न	११	२०	११×१ . ११
छोटो प्रश्न	८	७२	८×५ . ४०
लामो प्रश्न	३	४३	३×८ . २४
जम्मा	२२	२ घन्टा १५ मिनेट	७५

द्रष्टव्य :

- सबै प्रश्न अनिवार्य हुने छन् ।
- अति छोटा प्रश्न ११ ओटा सोधिने छ र प्रत्येक प्रश्नको अंकभार १ हुनेछ ।
- छोटा प्रश्नहरु ८ ओटा हुनेछन् र प्रत्येकको अंकभार ५ हुनेछ ।
- लामा प्रश्नहरु ३ ओटा हुनेछन् र प्रत्येकको अंकभार ८ हुनेछ ।
- प्रश्नहरु माथि उल्लिखित ज्ञान, बोध, प्रयोग तथा सिप र उच्च दक्षताको प्रश्नहरु निर्धारित प्रतिशत भार मिल्ने गरी निर्माण गर्नुपर्ने छ ।

  उच्च दक्षता अन्तर्गत, विश्लेषण, मूल्यांकन, सिर्जनात्मक र मूल्य सम्बन्धी प्रश्नहरु समावेश गर्नुपर्ने छ

Technical and Vocational Stream

Secondary Education Curriculum

Mathematics

Grades: 11 and 12 **Credit hrs.: 3** **Working hrs.: 96**

1. Introduction

Mathematics is an essential in the field of engineering, medicine, natural sciences, finance and other social sciences. The branch of mathematics concerned with application of mathematical knowledge to other fields and inspires new mathematical discoveries. School mathematics is necessary as the backbone for higher study in different disciplines.

This course of Mathematicsis designed for grade 11 and 12 students of engineering as a subject as per the curriculum structure prescribed by the National Curriculum Framework, 2076 of TEVT stream. The content areas of this curriculum are Algebra, Trigonometry, Analytic Geometry, Vectors, Statistics and Probability, and Calculus.

This course will be delivered using both the conceptual and theoretical inputs through demonstration and presentation, discussion, and group works as well as practical and project works in the real world context.

2. Level-wise Competencies

On completion of this course, students will have the following competencies:

1. Use basic properties of elementary functions and their inverse including linear, quadratic, reciprocal, polynomial, rational, absolute value, exponential, logarithm, sine, cosine and tangent functions.
2. Use principles of elementary logic to find the validity of statement and also acquire knowledge of matrix, sequence and series, and combinatory.
3. Make connections and present the relationships between abstract algebraic structures with familiar number systems such as the integers, real numbers and complex numbers.
4. Identify and derive equations for lines, circles, parabolas, ellipses, and hyperbolas, and identify the plane and its properties in space.
5. Apply knowledge of statistics and probability in daily life.

6. Use vectors in daily life.
7. Solve the problems related to limit, continuity and derivative and determine the extreme values of function in daily life.
8. Explain anti-derivatives as an inverse process of derivative and use them in various situations.

3. Grade-wise Learning Outcomes

On completion of the course, the students will be able to:

S. N.	Content Domain/area	Learning Outcomes	
		Grade 11	**Grade 12**
1.	**Algebra**	1.1 acquaint with logical connectives andconstruct truth tables. 1.2 prove set identities. 1.3 define interval and absolute value of real numbers. 1.4 Define function, domain and range of a function, inverse function. 1.5 Find inverse function of given invertible function. 1.6 Define sequence and series. 1.7 Classify sequences and series (arithmetic, geometric, harmonic). 1.8 Solve the problems related to arithmetic, geometric and harmonic sequences and series. 1.9 Establish relation among A.M, G. M and H.M. 1.10 Find the sum of infinite geometric series.	1.1 Solve the problems related to permutation and combinations. 1.2 State and prove binomial theorems for positive integral index. 1.3 State binomial theorem for any integer (without proof). 1.4 Find the general term and binomial coefficient. 1.5 Define Euler's number. 1.6 Expand e^x and log(1+x) using binomial theorem. 1.7 State and prove De Moivre's theorem. 1.8 find the sum of finite natural numbers, sum of squares of first n-natural numbers, sum of cubes of first n-natural numbers. 1.9 Define and apply mathematical induction.

		1.11 Obtain transpose of matrix and verify its properties. 1.12 Calculate minors, cofactors, adjoint,determinant and inverse of a square matrix. 1.13 Define a complex number. 1.14 Solve the problems related to algebra of complex numbers. 1.15 Find conjugate and absolute value (modulus) of a complex numbers and verify their properties. 1.16 express complex number in polar form.	1.10 Find square root of a complex number. 1.11 Express complex number in polar form. 1.12 Find the roots of a complex number by De Moivre's theorem. 1.13 Solve the problems using properties of cube roots of unity. 1.14 Define polynomial function and polynomial equation. 1.15 Find roots of a quadratic equation. 1.16 Establish the relation between roots and coefficient of quadratic equation. 1.17 Form a quadratic equation with given roots.
2.	**Trigonometry**	2.1 Define inverse circular functions establish the relations on inverse circular functions. 2.2 Find the general solution of trigonometric equations	2.1 Solve the problems using properties of a triangle (sine law, cosine law, tangent law, projection laws, and half angle laws). 2.2 Solve the triangle(simple cases)
3.	**Analytic geometry**	3.1 find the length of perpendicular from a given point to a given line 3.2 find the equation of bisectors of the angles between two straight lines 3.3 Write the condition of general equation of second degree in x	3.1 Find equation of circle 3.2 Define tangent and normal of circle and find condition of tangencyof a line at a point to the circle 3.3 State the standard equations of parabola, Ellipse and hyperbola

		and y to represent a pair of straight lines. 3.4 Define homogenous second-degree equation in x and y. 3.5 Find bisectors of the angles between pair of lines.	3.4 Define Coordinate axes and coordinate planes in three dimensions andcoordinates of a point. 3.5 Find distance between two points and section formula. 3.6 Find direction ratios and direction cosines of a line.
4.	**Vectors**	4.1 Define vector. 4.2 Find scalar product of two vectors. 4.3 Find angle between two vectors. 4.4 Interpret scalar product of vectors geometrically. 4.5 Apply properties of scalar product of vectors in trigonometry and geometry.	4.1 Define vector product of two vectors, interpretation vector product geometrically. 4.2 Solve the problems using properties of vector product. 4.3 Apply vector product in geometry and trigonometry.
5.	**Statistics and Probability**	5.1 Define measure of dispersion 5.2Define and calculate range, mean deviation and quartile deviations and their coefficients. 5.3 Define random experiment, sample space, event, equally likely cases, mutually exclusive events, exhaustive cases, favorable cases, independent and dependent events. 5.4 Find the probability using two basic laws of probability. addition theorem of probability and Multiplication theorem of probability (	5.1 Define and calculate standard deviation, variance and coefficient of variation. 5.2 Define and calculate skewness. 5.3 Define dependent events and conditional probability (without proof) 5.4 Define binomial distribution, 5.5 Calculate mean and standard deviation of Binomial distribution 5.6 Define conditional probability. 5.7 State Bayes theorem and use it in solving problems.

		independent case only)	
6.	**Calculus**	6.1 Define limits of a function. 6.2 State rules of finding limits 6.3 Apply algebraic properties of limits. 6.4 State basic theorems on limits of algebraic, trigonometric, exponential and logarithmic functions, 6.5 Define and test continuity of a function. 6.5 Define and classify discontinuity. 6.6 Define derivative 6.7 Interpret derivatives geometrically. 6.8 Find the derivatives, derivative of a function by first principle (algebraic, trigonometric exponential and logarithmic functions). 6.9 Find the derivatives by using rules of differentiation (sum, difference, constant multiple, chain rule, product rule, quotient rule, power and general power rules). 6.10 Find the derivatives of parametric and implicit functions. 6.11 Calculate higher order derivatives. 6.12 Define integration as reverse of differentiation.	6.1 Find the derivatives of inverse trigonometric, exponential and logarithmic functions by definition. 6.2 Define increasing/decreasing functions, 6.3 Find tangents and normal, 6.4 Find extreme values of a function 6.5 Perform standard integrals, integrals reducible to standard forms, integrals of rational function. 6.6 Define differential equation and its order,degree, differential equations of first order and first degree, 6.7 Solve the differential equations with separable variables, homogenous, linear and exact differential equations.

		6.13 Evaluate the integral using basic integrals. 6.14 Integrate by substitution and integration by parts method. 6.15 Use definite integral to find the area under the given curve, 6.16 Find the area between two curves.	

4. Scope and Sequence of Contents

S.N.	Content area	Grade 11		Grade 12	
		Contents	**W. Hrs. (Th.+Pr.)**		**W. Hrs. (Th.+Pr.)**
1	**Algebra**	**1.1 Logic and Set**: Statements, logical connectives, truth tables, theorems based on set operations. **1.2 Real numbers:** Geometric representation of real numbers, interval, absolute value. **1.3 Function** ▪ Domain and range of a function, injective, surjective, bijective function, types of Function (algebraic, trigonometric, exponential, logarithmic), inverse function **1.4 Sequence and series:**	24	**1.1 Permutation and combination**: ▪ Basic principle of counting, ▪ Permutation ▪ Combination of things all different, ▪ Properties of combination **1.2 Binomial Theorem:** ▪ Binomial theorem for a positive integral index, general term. ▪ Binomial coefficient, ▪ Euler's number. ▪ Expansion of e^x and log(1+x) (without proof)	24

		▪ Arithmetic, geometric, harmonic sequences and series and their properties ▪ A.M, G.M, H.M and their relations, ▪ Sum of infinite geometric series. **1.5 Matrices and determinants:** ▪ Matrix and its properties,transpose of a matrix, minors and cofactors, adjoint matrix ▪ Determinant of a square matrix, ▪ Inverse matrix, ▪ Properties of determinants (without proof) **1.6 Complex number:** ▪ Definition, imaginary unit, algebra of complex numbers, geometric representation, absolute (Modulus)value and conjugate of a complex numbers and their properties ▪ Polar form of complex numbers.		**1.3 Sequence and series:** ▪ Sum of first n natural numbers ▪ Sum of squares of first n numbers ▪ Sums of cubes of first n natural numbers **1.4 Mathematical Induction** ▪ Principle of mathematical induction and some application **1.5 Complex Numbers :** ▪ De' Moivre'sTheorem and its application in finding the roots of unity and its properties. **1.6** Quadratic Equation ▪ Solution of quadratic Equation ▪ Nature or roots of quadratic Equation.	
2	**Trigonometry**	**2.1 Inverse circular functions** **2.2 Trigonometric equations and general**	12	**2.1 Properties of a triangle** Sine law, Cosine law, Tangent law, Projection	12

		values		laws, Half angle laws. **2.2 Solution of triangle(simple cases)**	
3	**Analytic Geometry**	**3.1 Straight line** ▪ Length of perpendicular from a given point to a given line, Bisectors of the angles between two straight lines. **3.2 Pair of straight lines**: ▪ General equation of second degree in x and y, ▪ Condition for representing a pair of lines. ▪ Homogenous second-degree equation in x and y. ▪ Angle between pair of lines. ▪ Bisectors of the angles between pair of lines.	12	**3.1 Conic section: Circle**: ▪ Equation of circle, tangent and normal to a circle, condition of tangency of a line at a point to the circle ▪ Standard equations of parabola, Ellipse and hyperbola. **3.2 Coordinates in space**: ▪ Coordinate axes and coordinate planes in three dimensions. Coordinates of a point. ▪ Distance between two points and section formula. ▪ Direction cosines and direction ratios of a line joining two points.	12
4	**Vectors**	**4.1 Product of vectors:** ▪ Scalar product of two vectors, angle between two vectors, ▪ Geometric interpretation of scalar product, ▪ Properties of scalar	8	**4.1 Product of Vectors:** ▪ Vector product of two vectors, geometrical interpretation of vector product, properties of vector product, ▪ Application of vector	8

		product,		and scalar product	
5	**Statistics and Probability**	**5.1 Measure of Dispersion:** ▪ Range ▪ Quartile deviation, coefficient of QD ▪ Mean deviation **5.2 Probability** ▪ Random experiment, Sample space and events ▪ Definitionof probability: Empirical and mathematical definition of probability ▪ Addition and multiplication laws of probability(independent case only)	12	**5.1 Measure of Dispersion:** ▪ Standard deviation, variance, coefficient of variation, ▪ Skewess (Karl Pearson, Bowley) 5.3 **Probability**: ▪ Dependent cases, conditional probability (without proof), binomial distribution, mean and standard deviation of binomial distribution (without proof). ▪ Conditional Probability with Bayes theorem (statement only)	12
6	**Calculus**	**6.1 Limit and continuity**: ▪ Limit of a function. ▪ Rules of finding limits ▪ Algebraic properties of limits (without proof), ▪ Basic theorems on limits, ▪ Algebraic, trigonometric, exponential and logarithmic functions, ▪ Continuity of a	28	**6.1 Derivatives:** ▪ Derivative of inverse trigonometric, exponential and logarithmic function by definition, differentiating hyperbolic function **6.2 Applications of derivatives:**Increasing/ decreasing functions, tangents and normal, maxima and minima	28

		function, ▪ Types of discontinuity, graphs of discontinuous function. **6.2 Derivatives:** ▪ Derivative of a function as rate of change ▪ Derivatives of algebraic, trigonometric, exponential and logarithmic functions by definition (simple forms), ▪ Rules of differentiation. ▪ Second order derivative **6.3 Anti-derivatives:** ▪ Anti-derivative. integration using basic integrals, integration by substitution and by parts, ▪ the definite integral and its use to findan area under the given curve, ▪ Area between two curves.		**6.3 Anti-derivatives:** ▪ Anti-derivatives, standard integrals, integrals reducible to standard forms, integrals of rational function. **6.4 Differential equations**: ▪ Differential equation and its order, degree ▪ Differential equations of first order and first degree,differential equations with separable variables, homogenous, linear and exact differential equations.	
Total			**96**		**96**

**School must allocate separate classes for practical and project activities for students.*

5. Sample project works/practical work for grade 11

Sample project works/mathematical activities for grade 11

1. Prepare the model of types of function by using rubber band and nail in wooden panel.
2. Write two simple statements related to mathematics and write four compound statements by using them.

3. Prepare a model to illustrate the values of sine function and cosine function for different angles which are multiples of $\frac{\pi}{2}$ and π.

4. Draw the graph of $\sin^{-1}x$, using the graph of sin x and demonstrate the concept of mirror reflection (about the line y = x).

5. Prepare the model of straight lines in slope intercept, double intercept and normal form.

6. Verify that the equation of a line passing through the point of intersection of two lines $a_1x + b_1y = 0$ and $a_2x + b_2y = 0$ is of the form $(a_1x + b_1y) + K(a_2x + b_2y) = 0$.

7. Prepare a model and verify that the diagonals of rhombus bisect each other at right angles by using vector method.

8. Geometrically interpret the scalar product of two vectors.

9. Collect the scores of grade 10 students in mathematics and English from your school.

a. Make separate frequency distribution with class size 10.

b. Which subject has more uniform/consistent result? find it by using quartile deviation.

c. Make the group report and present.

10. Roll two dices simultaneously 20 times and list all outcomes. Write the events that the sum of numbers on the top of both dice is a) even b) odd in all above list. Examine either they are mutually exclusive or not. Also find the probabilities of both events.

11. Verify the geometrical significanceof derivative.

12. Find the area of circular region around your school using integration.

Sample project works/mathematical activities for grade 12

1. Represent the binomial theorem of power 1, 2, and 3 separately by using concrete materials and generalize it with n dimension relating with Pascal's triangle.

2. Prepare a model to explore the principal value of the function $\sin^{-1}x$ using a unit circle and present in the classroom.

3. Verify the sine law by taking particular triangle in four quadrants.

4. Take a circular object. Find its centre, radius and end points of a diameter using graph paper. Find the equation of that circle.

5. Prepare a concrete material to show parabola by using thread and nail in wooden panel.

6. Construct an ellipse using a rectangle.
7. Fix a point on the middle of the ceiling of your classroom. Find the distance between that point and four corners of the floor.
8. Express the area of triangle and parallelogram in terms of vector.
9. Verify geometrically that: $\vec{c} \times (\vec{a} + \vec{b}) = \vec{c} \times \vec{a} + \vec{c} \times \vec{b}$
10. Collect the students enrollment of past 5 years of two different technical school of your local community.

    (i) Find standard deviation.

    (ii) Which school has uniform enrollment? Find

    (iii) Find skewness and show it in diagram.
11. Take 4 white and 6 yellow balls of the same shape and size in a bag I. Similarly, take 3 white and 5 yellow balls of the same shape and size in the bag II. Now, draw one ball randomly from one of the bags and note down which ball you have drawn. Then, find the probability that it was drawn from the bag I.
12. Find, how many people will be there after 5 years in your local area by using the concept of differentiation.
13. Verify that the integration is the reverse process of differentiation with examples and curves.

6. Learning Facilitation Method and Process

Teacher has to emphasis on the active learning process and on the creative solution of the exercise included in the textbook rather than teacher centered method while teaching mathematics. Students need to be encouraged to use the skills and knowledge related to mathematics in their house, neighborhood, school and daily activities. Teacher has to analyze and diagnose the weakness of the students and create appropriate learning environment to solve mathematical problems in the process of teaching learning.

The emphasis should be given to use diverse methods and techniques for learning facilitation. However, the focus should be given to those method and techniques that promotestudents' active participation in the learning process. The following are some of the teaching methods that can be used to develop mathematical competencies of the students:

- Inductive and deductive method
- Problem solving method
- Case study
- Project work method
- Question answer and discussion method
- Discovery method/ use of ICT
- Co-operative learning

7. Student Assessment

Evaluation is an integral part of learning process. Both formative and summative evaluation system will be used to evaluate the learning of the students. Studentsshould be evaluated to assess the learning achievements of the students. There are two basic purposes of evaluating students in Mathematics: first, to provide regular feedback to the students and bringing improvement in student learning-the formative purpose; and second, to identify student's learning levels for decision making.

a. Internal Examination/Assessment

Internal assessment includes classroom participation, terminal examinations, and project work/practical work (computer works and lab work)and presentation. The scores of evaluation will be used for providing feedback and to improve their learning. Individual and group works are assigned as projects.

The basis of internal assessment is as follows:

Classroom participation	Marks from terminal examinations	project work/practical work	Total
3	6	16	25

(i) Classroom participation

Marks for classroom participation is 3 which is given on the basis of attendance and participation of students in activities in each grade.

(ii) Marks from trimester examinations

Marks from each trimester examination will be converted into full marks 3 and calculated total marks of two trimester in each grade.

(iii) Project work/practical work

Each Student should do at least one project work/practical work from each of six content areas and also be required to give a 15 minutes presentation for each project work and practical work in classroom. These project works/practical works will be documented in a file and will be submitted at the time of practical evaluation. Out of six projects/practical works from each area any one project work/practical work should be presented at the time of practical evaluation by student.

b. External Examination/Evaluation

External evaluation of the students will be based on the written examination at the end of each grade. It carries 75 percent of the total weightage. The types and number questions will be as per the test specification chart developed by the Curriculum Development Centre.

Specification Grid

Grade: 11 and 12 **Subject: Mathematics** **Time: 3 hrs.**

SN	Content Area	Working hour (Th.)	Competency level																Areawise Marks	Number of Questions
			Knowledge				Understanding						Application						Higher Ability							
			MCQ		SAQ		MCQ		SAQ		LAQ		MCQ		SAQ		LAQ		MCQ		SAQ		LAQ			
			No. of Questions	Marks	No. of Questions	Marks	No. of Questions	Marks	No. of Questions	Marks	No. of Questions	Marks	No. of Questions	Marks	No. of Questions	Marks	No. of Questions	Marks	No. of Questions	Marks	No. of Questions	Marks	No. of Questions	Marks		
1	**Algebra**	18	2	2	2	10	5	5	1	5	1	8	2	2	4	20	1	8	2	2	1	5	1	8	20	MCQ: 2 SAQ: 2 LAQ: 1
2	**Trigonometry**	9																							9	MCQ: 5 SAQ: 4 LAQ: 1
3	**Analytic Geometry**	9																							9	
4	**Vector**	6																							6	
5	**Statistics & Probability**	9																							9	
6	**Calculus**	21																							22	MCQ: 4 SAQ: 2 LAQ: 1
Total Marks		**72**	**12**				**18**						**30**						**15**						**75**	MCQ: 11 SAQ: 8 LAQ: 3

Question format plan								
S.N.	Types of Questions	Marks per question	Number of questions					
			Knowledge	Understanding	Application	Higher Ability	Total number of questions	Total Marks
1.	Multiple Choice Question	1	2	5	2	2	11	11
2.	Short Answer Question	5	2	1	4	1	8	40
3.	Long Answer Question	8	0	1	1	1	3	24
Grand Total			**4**	**7**	**7**	**4**	**22**	**75**

Note:

- *Appropriate extra time will be provided for the handicapped students.*
- *Questions should be prepared by giving the context and one question may have more than one sub-questions.*
- *Application and higher ability questions can be made by relating the other content areas.*
- *Questions should be made by addressing all the sub-areas of content.*

At least one multiple choice question should be asked from each area.

Technical and Vocational Stream

Secondary EducationCurriculum

Chemistry

Grade: 11 and 12 **Credit hour: 3** **Working hour: 96 (Th 72+ Pr 24)**

1. Introduction

This curriculum is of grade 11 and 12 chemistry. This is designed to provide students with general understanding of the fundamental scientific laws and principles that govern the scientific phenomena in the world. It focuses to develop scientific knowledge, skills, and attitudes required at secondary level (grade 11 and 12) irrespective of what they do beyond this level, as envisioned by national goals. Understanding of scientific concepts and their application, in day to day context as well as the process of obtaining new knowledge through holistic approach of learning in the spirit of national qualification framework is emphasized in the curriculum.

This curriculum aims: to provide sufficient knowledge and skills to recognize the usefulness and limitations of laws and principles of chemistry, to develop science related attitudes such as concern for safety and efficiency, concern for accuracy and precision, objectivity, spirit of enquiry, inventiveness, appreciation of ethno-science, and willingness to use technology for effective communication, to provide opportunity for the learners who have deeper interest in the subject to delve into the more advanced contents so that the study of chemistry becomes enjoyable and satisfying to all.

The curriculum prepared in accordance with National Curriculum Framework is structured for two academic years in such a way that it incorporates the level-wise competencies, grade-wise learning outcomes, scope and sequence of contents, suggested practical/project-work activities, learning facilitation process and assessment strategies so as to enhance the learning of the subject systematically.

2. Level-wise competencies

The expected competencies of this course are to:

1. Apply appropriate principles, concepts, theories, laws, models and patterns to interpret the findings, draw conclusion, make generalization, and to predict from chemical facts, observation and experimental data.
2. Correlate old principles, concepts, theories, laws, tools, techniques; to the modern, sustainable and cost-effective skills, tools and techniques in the development of scientific attitude.
3. Apply the principles and methods of science to develop the scientific skill in an industrial process to produce various chemicals in small as well as in industrial scale that are useful in our daily life and in the service of mankind.
4. Explain the social, economic, environmental and other implications of chemistry and appreciate the advancement of chemistry and its applications as essential for the growth of national economy.
5. Describe chemistry as a coherent and developing framework of knowledge based on fundamental theories of the structure and process of the physical world.
6. Perform skills in safe handling of chemicals, taking into account of their physical and chemical properties, risk, environmental hazards, etc.
7. Conduct either a research work or an innovative work in an academic year, under the guidance of teacher, using the knowledge and skills learnt.

3. Grade-wise learning Outcomes

Grade 11	Grade 12
Content Area: General and Physical Chemistry	
1. Foundation and Fundamentals 1.1 Recognize the importance and scope of chemistry. 1.2 Explain the terms atom, molecule, radicals, valency, molecular formula and empirical formula. 1.3 Calculate percentage composition of constituent elements from molecular formula. 1.4 Define and use the terms relative atomic mass, relative molecular mass and relative formula mass.	**1. Volumetric Analysis** 1.1 Define and explain the terms volumetric and gravimetric analysis. 1.2 Express the concentration of solutions in terms of percentage, g/l, molarity, molality, normality, ppm, ppb 1.3 Define and calculate the equivalent weight of (elements, acids, bases, salts, oxidizing and reducing agents). 1.4 Law of equivalence and normality equation and their application for chemical calculation. 1.5 Define and explain primary and secondary standard substance. 1.6 Explain different types of titration and their applications. (related numerical problems)
2. Stoichiometry 2.1 Explain Dalton's atomic theory and its postulates. 2.2 State and explain laws of stoichiometry (law of conservation of mass, law of constant proportion, law of multiple proportion, law of reciprocal proportion and law of gaseous volume). 2.3 Explain Avogadro's hypothesis and deduce	**2. Ionic Equilibrium** 2.1 Explain the limitations of Arrhenius concepts of acids and bases. 2.2 Define Bronsted and Lowry concepts for acids and bases. 2.3 Define conjugate acids and conjugate base. 2.4 Identify conjugate acid-base pairs of Bronsted acid and base. 2.5 Define and explain Lewis acids and bases. 2.6 Explain ionization constant of water and calculate pH and pOH in aqueous medium using Kw values. 2.7 Solubility and solubility product principle.

some relationships among molecular mass with vapour density, volume of gas and number of particles. 2.4 Define mole and explain its relation with mass, volume and number of particles.(mole concept related numerical problems)	2.8 Show understanding of the common ion effect. 2.9 Describe the application of solubility product principle and common ion effect in precipitation reactions. 2.10 Define a Buffer solution and show with equations how a Buffer system works. 2.11 Define and differentiate different types of salts (simple salts, complex salt, acidic salts, basic salts and neutral salts).
3. Atomic Structure 3.1 Explain Rutherford atomic model and its limitations. 3.2 Summarize Bohr's atomic theory; its importance and limitations. 3.3 Explain the origin of hydrogen spectra with the help of Bohr's model. 3.4 Explain quantum numbers. 3.5 Explain the concept and general shapes of s and p orbitals. **3.6** Use Aufbau principle, Pauli Exclusion Principle and Hund's rule to write the electronic configuration of the atoms and ions.	**3. Chemical Kinetics** 3.1 Define chemical kinetics. 3.2 Explain and use the terms rate of reaction, rate equation, rate constant. 3.3 Explain qualitatively factors affecting rate of reaction. 3.4 Derive and explain integrated rate equation and half life for zero, and first order reaction. 3.5 Explain the significance of Arrhenius equation and solve the related problems. 3.6 Solve related numerical problems based on rate, rate constant and order of zero and first order reactions.
4. Classification of elements and Periodic Table 4.1 Explain modern periodic table and its features.	**4. Thermodynamics** 4.1 Define thermodynamics. 4.2 Explain the energy change in chemical reactions.

4.2 Classify the elements of periodic table in different blocks and groups. 4.3 Define the term nuclear charge and effective nuclear charge. 4.4 Explain and interpret the Periodic trend of atomic radii, ionic radii, ionization energy, electronegativity, electron affinity and metallic characters of elements.	4.3 Define the terms internal energy and state function. 4.4 State and explain first law of thermodynamics. 4.5 State and explain enthalpy and enthalpy changes in various process (enthalpy of solution, enthalpy of formation enthalpy of combustion and enthalpy of reaction). 4.6 Explain endothermic and exothermic process with the help of energy profile diagram. 4.7 State Hess's law of constant heat summation (thermo-chemistry) and solve numerical problems related to Hess's law. 4.8 Define the term entropy and spontaneity. 4.9 State and explain second law of thermodynamics. 4.10 Define standard Gibbs free energy change of reaction by means of the equation $\Delta G = \Delta H - T\Delta S$. 4.11 State whether a reaction or process will be spontaneous by using the sign of ΔG. 4.12 Explain the relationship between ΔG and equilibrium constant.
5. Chemical Bonding and Shapes of Molecules 5.1 Valence shell, valence electron and octet rule 5.2 Explain the ionic bond and the properties of ionic compounds. 5.3 Explain the covalent bond, co-ordinate bond and the properties of covalent compound. 5.4 Describe the co-ordinate covalent compounds with some examples. 5.5 Lewis dot system for structure of compound.	**5. Electrochemistry** 5.1. Electrode potential and standard electrode potential 5.2. Types of electrodes: Standard hydrogen electrode and calomel electrodes 5.3. Define electrochemical series and its application 5.4. Voltaic cell: Zn-Cu cell, Ag-Cu cell 5.5. Cell potential and standard cell potential

5.6 Write the lewis dot diagrams of some ionic and covalent compounds (NaCl, MgCl2, NH4Cl, Oxides of Hydrogen, Nitrogen and Phosphorous, common mineral acids). 5.7 Write the resonance structure of some covalent species. 5.8 Use VSEPR theory to describe the shapes of simple covalent molecules(BeF_2, BF_3, CH_4, H_2O, NH_3, CO_2, PCl_5 dtc). 5.9 Describe the concept of hybridization in simple covalent molecules.	
6. Oxidation and Reduction 6.1 Define oxidation and reduction in terms of electronic concept. 6.2 Define oxidation number and explain the rules of assigning oxidation number. 6.3 Calculate oxidation numbers of elements in compounds and ions. 6.4 Explain redox reaction, oxidizing and reducing agent. 6.5 Balance the given redox reaction by oxidation number method or ion electron method (half equation method). 6.6 Explain the qualitative and quantitative aspects of faradays laws of electrolysis.	-

7. States of Matter 7.1 List the postulates of kinetic molecular theory. 7.2 State and explain Gas laws, related equations and related numerical problems. 7.3 Explain Boyle's law, Charle's law, Avogadro law, combined gas law, Daltons law, Graham's law 7.4 State and use the general gas equation PV = nRT in calculations. 7.5 Explain the meaning of Universal gas constant and its significance. 7.6 Distinguish between real gas and ideal gas. 7.7 Deviation of real gas from ideality (solving related numerical problems based on gas laws). 7.8 Explain the physical properties of liquid like Evaporation and condensation, vapour pressure and boiling, surface tension and viscosity in terms of intermolecular force and intermolecular space. 7.9 Describe Liquid crystals and their applications. 7.10 Differentiate between amorphous and crystalline solids.	-

7.11 Define unit cell, crystal lattice, efflorescence, deliquescence, hygroscopy, water of crystallization with examples.	
Content Area: Inorganic Chemistry	
8. Chemistry of Non-metals 7.1 Describe and compare the chemistry of atomic and nascent hydrogen. 7.2 Explain isotopes of hydrogen and their uses, application of hydrogen as fuel, heavy water and its applications. 7.3 Allotropes of oxygen 7.4 Explain types of oxides (acidic, basic, neutral, amphoteric, peroxide and mixed oxides). 7.5 Describe occurrence, preparation (from oxygen), structure and test of ozone. 7.6 Describe ozone layer depletion (causes, effects and control measures) and uses of ozone. 7.7 Give reason for inertness of nitrogen and active nitrogen. 7.8 Give chemical properties of ammonia [Action with air(O_2),$CuSO_4$ solution, water, $FeCl_3$ solution, Conc. HCl, Mercurous nitrate paper,] and uses.	**6. Chemistry of Metals** 6.1 Define metallurgy and its types (hydrometallurgy, pyrometallurgy, and electrometallurgy). 6.2 Define ores, gangue or matrix, flux and slag, alloy and amalgam. 6.3 Explain general principles of extraction of metals (different processes involved in metallurgy) – concentration, calcination and roasting, smelting, carbon reduction, thermite and electrochemical reduction, refining of metals (poling and electro-refinement).

7.9	Explain the chemical properties of nitric acid [HNO_3] as an acid and oxidizing agent (action with zinc, magnesium, iron, copper, sulphur, carbon, SO_2 and H_2S) and uses.	
7.10	Ring test for determination of nitrate ion (NO_3^-).	
7.11	Explain general characteristics of halogens.	
7.12	Compare the methods of preparation of halogens without diagram and description.	
7.13	Explain allotropes of carbon (crystalline and amorphous) including fullerenes (structure, general properties and uses).	
7.14	Allotropes of sulphur and their uses.	
7.15	Prepare hydrogen sulphide gas by using Kipp's apparatus.	
7.16	Explain itsproperties (Acidic nature, reducing nature, analytical reagent) and uses of hydrogen sulphide.	

9. Chemistry of Metals	**7. Studies of Heavy Metals**
9.1 Give general characteristics of alkali metals. 9.2 State and explain extraction of sodium from Down's process. 9.3 Describe properties of sodium (action with Oxygen, water, acids nonmetals and ammonia) and uses. 9.4 Explain properties and uses of sodium hydroxide (precipitation reaction and action with carbon monoxide). 9.5 State and explain properties and uses of sodium carbonate (action with CO2, SO2, water, precipitation reactions). 9.6 Give general characteristics of alkaline earth metals. 9.7 Write molecular formula and uses of (quick lime, bleaching powder, magnesia plaster of paris and epsom salt). 9.8 Explain solubility of hydroxides, carbonates and sulphates of alkaline earth metals. **9.9** Explain stability of carbonate and nitrate of alkaline earth metals.	7.1 Explain occurrence and extraction of copper, iron and zinc metals 7.2 Explain chemistry (preparation, properties and uses) of blue vitriol. 7.3 Write molecular formula and uses of red and black oxide of copper. 7.4 Describe properties (with air, acid, alkali, displacement reaction) and uses of zinc. 7.5 Explain chemistry (preparation, properties and uses) of white vitriol. 7.6 Explain properties and uses of iron. 7.7 Explain manufacture of steel by basic oxygen method and Open-Hearth process. 7.8 Explain corrosion of iron and its prevention.
Content Area: Organic Chemistry	

10. Basic concept of organic chemistry 10.1 Define organic chemistry and organic compounds. 10.2 Explain tetra-covalency and catenation property of carbon. 10.3 Describe classification of organic compounds. 10.4 Define functional groups and homologous series with examples. 10.5 State and explain the structural formula, contracted formula and bond line structural formula. 10.6 Introduce preliminary idea of cracking and reforming, quality of gasoline, octane number, cetane number and gasoline additive.	**8. Haloalkanes** 8.1 Describe briefly the nomenclature, isomerism and classification of monohaloalkanes. 8.2 Show the preparation of monohaloalkanes from alkanes, alkenes and alcohols. 8.3 Describe elimination reaction (dehydrohalogenation- Saytzeff's rule), Reduction reactions, Wurtz reaction. 8.4 Show the preparation of trichloromethane from ethanol and propanone. 8.5 Explain the chemical properties of trichloromethane: oxidation, reduction, action on silver powder, conc. nitric acid, propanone, and aqueous alkali.
11: Fundamental principles 11.1 State IUPAC name of the organic compounds. 11.2 Detect N, S and halogens(X) in organic compounds by Lassaigne's test. 11.3 Define and classify isomerism in organic compounds (structure isomerism, types of structure isomerism: chain isomerism, position, isomerism, functional isomerism,	**9. Alcohols** 9.1 Describe briefly the nomenclature, isomerism and classification of monohydric alcohol. 9.2 Show the preparation of monohydric alcohols from Haloalkane, primary amines and esters. 9.3 Define absolute alcohol, power alcohol, denatured alcohol (methylated spirit), rectified spirit; and alcoholic beverage.

metamerism and tautomerism).	
12. Hydrocarbons 12.1 Define and describe saturated and unsaturated hydrocarbons (alkane alkene and alkyne). 12.2 Show preparation of alkanes from haloalkanes (Reduction and Wurtz reaction), Decarboxylation, Catalytic hydrogenation of alkene and alkyne. 12.3 Explain chemical properties of alkanes: substitution reactions (halogenation, nitration, and sulphonation only) 12.4 Explain chemical properties of alkenes, i.e. addition reaction with HX (Markovnikov's addition and peroxide effect), H2O, O3 and H2SO4 only. 12.5 Describe chemical properties of alkynes, i.e. addition reaction with (H2, HX, H2O), acidic nature (action with Sodium, ammoniacal AgNO3 and ammoniacal Cu2Cl2).	**10. Phenols** 10.1 Describe briefly the nomenclature of phenol. 10.2 Show the preparation of phenol from chlorobenzene, Diazonium salt and benzene sulphonic acid 10.3 State physical properties of phenol. 10.4 State important uses of phenol.
13. Aromatic Hydrocarbons 13.1 Define aromatic compounds and their characteristics.	**11. Aldehydes and Ketones** 11.1 Describe briefly the nomenclature and isomerism of aliphatic aldehydes and ketones.

13.2 State and explain Huckel's rule, Kekule structure of benzene, resonance and isomerism. 13.3 Show the preparation of benzene from: decarboxylation of sodium benzoate, phenol, ethyne and chlorobenzene. 13.4 Explain physical and chemical properties of benzene (Addition reaction: hydrogen, halogen and ozone, Electrophilic substitution reactions: orientation of benzene derivatives (o, m & p), nitration, sulphonation, halogenation Friedal-Craft's alkylation and acylation, combustion of benzene) and uses.	11.2 Show the preparation of aldehydes and ketones from dehydrogenation, oxidation of alcohol, ozonolysis of alkenes, acid chloride, gem dihaloalkane and catalytic hydration of alkynes 11.3 State physical properties and uses of aldehydes and ketones. 11.4 Distinguish between aliphatic aldehydes and ketones by using 2,4- DNP reagent, Tollen's reagent and Fehling's solution. 11.5 Define formalin and state its uses.
Content Area: Applied Chemistry	
14. Modern Chemical Manufactures 14.1 State and show manufacture of ammonia by Haber's process (principle and flow-sheet diagram). 14.2 State and show manufacture of nitric acid by Ostwald's process (principle and flow-sheet diagram). 14.3 Fertilizers (types of chemical fertilizers and production of urea with flow-sheet diagram)	**12. Chemistry in the Service of Mankind** 12.1 Explain addition and condensation polymers. 12.2 Explain elastomers and fibres. 12.3 Describe natural and synthetic polymers. 12.4 Explain some synthetic polymers (polythene, PVC, Teflon, polystyrene, nylon and bakelite). 12.5 Describe characteristics of drugs. 12.6 Differentiate natural and synthetic drugs. 12.7 Classify some common drugs. 12.8 Be aware of adverse effect of drug addiction. **12.9** Explain insecticides, herbicides and fungicides.

	13. Nuclear Chemistry and Applications of Radioactivity 13.1 Describe natural and artificial radioactivity. 13.2 Units of radioactivity. 13.3 Explain nuclear reactions. 13.4 Distinguish between nuclear fission and fusion reactions. 13.5 Describe nuclear power and nuclear weapons. 13.6 Explain industrial uses of radioactivity. 13.7 State the medical uses of radioactivity. 13.8 Explain radiocarbon dating. 13.9 Describe harmful effects of nuclear radiations.

4. Scope and Sequence of Contents (Theory)

Grade 11	T H	Grade 12	T H
Content Area: General and Physical Chemistry			
1. Foundation and Fundamentals 1.1 General introduction of chemistry 1.2 Importance and scope of chemistry 1.3 Basic concepts of chemistry (atoms, molecules, relative masses of atoms and molecules, atomic mass unit (amu), radicals, molecular formula, empirical formula) 1.4 Percentage composition from molecular formula	**2**	**1. Volumetric Analysis** 1.1 Introduction to gravimetric analysis, volumetric analysis and equivalent weight 1.2 Relationship between equivalent weight, atomic weight and valency 1.3 Equivalent weight of compounds (acid, base, salt, oxidizing and reducing agents) 1.4 Concentration of solution and its units in terms of:Percentage, g/L, molarity, molality, normality and formality, ppm and ppb	**8**

		1.5 Primary and secondary standard substances 1.6 Law of equivalence and normality equation 1.7 Titration and its types: Acid-base titration, redox titration (related numerical problems)	
2. Stoichiometry 2.1 Dalton's atomic theory and its postulates 2.2 Laws of stoichiometry 2.3 Avogadro's law and some deductions 2.3.1 Molecular mass and vapour density 2.3.2 Molecular mass and volume of gas 2.3.3 Molecular mass and no. of particles 2.4 Mole and its relation with mass, volume and number of particles 2.5 Calculations based on mole concept	**5**	**2. Ionic Equilibrium** **Introduction to Acids and Bases** 2.1 Limitation of Arrhenius concepts of acids and bases 2.2 Bronsted –Lowry definition of acids and bases 2.3 Relative strength of acids and bases 2.4 Conjugate acid –base pairs 2.5 Lewis definition of acids and bases 2.6 pH value: pH of strong and weak acids, pH of strong and weak bases 2.7 Solubility and solubility product principle 2.8 Common Ion effect 2.9 Application of solubility product principle and common ion effect in precipitation reactions 2.10 Buffer solution and its application 2.11 Types of salts: Acidic salts, basic salts, simple salts, complex salts (introduction and examples)	**8**
3. Atomic Structure 3.3 Postulates of Bohr's atomic model and its application	**5**	**3. Chemical Kinetics** 3.1 Introduction to chemical kinetics	**6**

3.4 Spectrum of hydrogen atom 3.5 Defects of Bohr's theory 3.6 Quantum Numbers 3.7 Orbitals and shape of s and p orbitals only 3.8 Aufbau Principle 3.9 Pauli's exclusion principle 3.10 Hund's rule and electronic configurations of atoms and ions (up to atomic no. 30)		3.2 Rate of reactions: Average and instantaneous rate of reactions 3.3 Rate law and its expressions 3.4 Rate constant and its unit and significance 3.5 Half-life of zero and first order reactions 3.6 Activation energy 3.7 Factors affecting rate of reactions: Effect of concentration, temperature (Arrhenius Equation) and effect of catalyst (energy profile diagram) 3.9 Related numerical problems	
4. Classification of elements and Periodic Table 4.1 Modern periodic law and modern periodic table - classification of elements into different groups, periods and blocks 4.2 Nuclear charge and effective nuclear charge 4.3 Periodic trend and periodicity 4.3.1 Atomic radii 4.3.2 Ionic radii 4.3.3 Ionization energy 4.3.4 Electron affinity 4.3.5 Electronegativity 4.3.6 Metallic characters (General trend and explanation only)	**4**	**4. Thermodynamics** 4.1 Introduction to thermodynamics 4.2 Energy in chemical reactions 4.3 Internal energy 4.4 First law of thermodynamics 4.5 Enthalpy and enthalpy changes: Endothermic and exothermic processes) 4.6 Enthalpy of reaction, enthalpy of solution, enthalpy of formation, enthalpy of combustion 4.7 Hess's law of thermochemistry 4.8 Entropy and spontaneity 4.9 Second law of thermodynamics 4.10 Gibbs' free energy and prediction of spontaneity 4.11 Relationship between ΔG and equilibrium	**8**

		constant (Solving related numerical problems)	
5. Chemical Bonding and Shapes of Molecules 5.1 Valence shell, valence electron and octet theory 5.2 Ionic bond and its properties 5.3 Covalent bond and coordinate covalent bond 5.4 Properties of covalent compounds 5.5 Lewis dot structure of some common compounds of s and p block elements 5.6 Resonance 5.7 VSEPR theory and shapes of some simple molecules (BeF_2, BF_3, CH_4, CH_3Cl, PCl_5, SF_6, H_2O,NH_3,CO_2,H_2S, PH_3) 5.8 Hybridization involving s and p orbitals only	**5**	**5. Electrochemistry** 5.1 Electrode potential and standard electrode potential 5.2 Types of electrodes: Standard hydrogen electrode and calomel electrodes 5.3 Electrochemical series and its applications 5.4 Voltaic cell: Zn-Cu cell, Ag- Cu cell 5.5 Cell potential and standard cell potential	**5**
6. Oxidation and Reduction 6.1 General and electronic concept of oxidation and reduction 6.2 Oxidation number and rules for assigning oxidation number 6.3 Balancing redox reactions by oxidation number and ion-electron (half reaction) method 6.4 Electrolysis 6.4.1 Qualitative aspect 6.4.2 Quantitative aspect(Faradays laws of electrolysis)	**5**	-	
7 States of Matter **7.1 Gaseous state**	**6**	-	

7.1.1 Kinetic theory of gas and its postulates 7.1.2 Gas laws 7.1.2.1 Boyle's law and Charles' law 7.1.2.2 Avogadro's law 7.1.2.3 Combined gas equation 7.1.2.4 Dalton's law of partial pressure 7.1.2.5 Graham's law of diffusion 7.1.3 Ideal gas and ideal gas equation 7.1.4 Universal gas constant and its significance 7.1.5 Deviation of real gas from ideality (Solving related numerical problems based on gas laws) **7.2 Liquid state** 7.2.1 Physical properties of liquids 7.2.1.1 Evaporation and condensation 7.2.1.2 Vapour pressure and boiling point 7.2.2 Liquid crystals and their applications **7.3 Solid state** 7.3.2 Amorphous and crystalline solids 7.3.3 Efflorescent, Deliquescent and Hygroscopic solids 7.3.4 Crystallization and crystal growth 7.3.5 Water of crystallization			
Content Area: Inorganic Chemistry			
8. Chemistry of Non-metals **8.1 Hydrogen** 8.1.1 Chemistry of atomic and nascent hydrogen	**3**	**6. Chemistry of Metals** **6.1 Metals and Metallurgical Principles** 6.1.1 Definition of metallurgy and its types	**5**

8.1.2 Isotopes of hydrogen and their uses 8.1.3 Application of hydrogen as fuel 8.1.4 Heavy water and its applications **8.2 Allotropes of Oxygen** 8.2.1 Definition of allotropy and examples 8.2.2 Oxygen: Types of oxides (acidic, basic, neutral, amphoteric, peroxide and mixed oxides) **8.3 Ozone** 8.3.1 Occurrence 8.3.2 Preparation of ozone from oxygen 8.3.3 Structure of ozone 8.3.4 Test for ozone 8.3.5 Ozone layer depletion (causes, effects and control measures) 8.3.6 Uses of ozone		(hydrometallurgy, pyrometallurgy, electrometallurgy) 6.1.2 Introduction of ores 6.1.3 Gangue or matrix, flux and slag, alloy and amalgam 6.1.4 General principles of extraction of metals (different processes involved in metallurgy) – concentration, calcination and roasting, smelting, carbon reduction, thermite and electrochemical reduction 6.1.5 Refining of metals (poling and electro-refinement)	
8.4 Nitrogen 8.4.1 Reason for inertness of nitrogen and active nitrogen 8.4.2 Chemical properties of ammonia [Action with $CuSO_4$ solution, water, $FeCl_3$ solution, Conc. HCl, Mercurous nitrate paper, O_2] 8.4.3 Uses and harmful effects of ammonia 8.4.6 Chemical properties of nitric acid [HNO_3 as an acid and oxidizing agent (action with zinc, magnesium, iron, copper, sulphur, carbon, SO_2 and H_2S) 8.4.7 Ring test for nitrate ion	**4**	**7. Studies of Heavy Metals** **7.1 Copper** 7.1.1 Occurrence and extraction of copper from copper pyrite 7.1.2 Properties (with air, acids, aqueous ammonia and metal ions) and uses of copper 7.1.3 Chemistry (preparation, properties and uses) of blue vitriol 7.1.4 Other compounds of copper (red oxide and black oxide of copper) formula and uses only	**10**

8.5 Halogens 8.5.1 General characteristics of halogens 8.5.2 Comparative study on preparation (no diagram and description is required),	**2**	**7.2 Zinc** 7.2.1 Occurrence and extraction of zinc from zinc blende 7.2.2 Properties (with air, acid, alkali, displacement reaction) and uses of zinc 7.2.3 Chemistry (preparation, properties and uses) of white vitriol **7.4 Iron** 7.4.1 Occurrence and extraction of iron 7.4.2 Properties and uses of iron 7.4.3 Manufacture of steel by Basic Oxygen Method and Open Hearth Process 7.4.4 Corrosion of iron and its prevention	
8.6 Carbon 8.6.1 Allotropes of carbon (crystalline and amorphous) including fullerenes (structure, general properties and uses only)	**1**		
8.7 Sulphur 8.7.1 Allotropes of sulphur (name only) and uses of sulphur 8.7.2 Hydrogen sulphide (preparation from Kipp's apparatus with diagram,) properties (Acidic nature, reducing nature, analytical reagent) and uses	**2**	-	
9.1 Alkali Metals 9.1.1 General characteristics of alkali metals 9.1.2 Sodium [extraction from Down's process, properties (action with Oxygen, water, acids nonmetals and ammonia) and uses] 9.1.3 Properties (precipitation reaction and action with	**5**	-	

carbon monooxide) and uses of sodium hydroxide 9.1.4 Properties (action with CO_2, SO_2, water, precipitation reactions) and uses of sodium carbonate **9.2 Alkaline Earth Metals** 9.2.1 General characteristics of alkaline earth metals 9.2.2 Molecular formula and uses of (quick lime, bleaching powder, magnesia, plaster of paris and epsom salt) 9.2.3 Solubility of hydroxides, carbonates and sulphates of alkaline earth metals (general trend with explanation) 9.2.4 Stability of carbonate and nitrate of alkaline earth metals (general trend with explanation)			
Content Area: Organic Chemistry			
10. Basic Concept of Organic Chemistry 10.1 Introduction to organic chemistry and organic compounds 10.2 Tetra-covalency and catenation properties of carbon 10.3 Classification of organic compounds 10.4 Alkyl groups, functional groups and homologous series 10.5 Idea of structural formula, contracted formula and bond line structural formula 10.6 Preliminary idea of cracking and reforming, quality of gasoline, octane number, cetane number and gasoline additive	**6**	**8. Haloalkanes** 8.1 Introduction 8.2 Nomenclature, isomerism and classification of monohaloalkanes 8.3 Preparation of monohaloalkanes from alkanes, alkenes and alcohols 8.4 Physical properties of monohaloalkanes 8.5 Preparation of trichloromethane from ethanol and propanone 8.6 Chemical properties of trichloromethane: oxidation, reduction, action on silver powder, conc. nitric acid, propanone, and aqueous alkali	**4**

11. Fundamental Principles of Organic Chemistry 11.1 IUPAC Nomenclature of Organic Compounds (upto chain having 6-carbon atoms) 11.2 Qualitative analysis of organic compounds (detection of N, S and halogens by Lassaigne's test) 11.3 Isomerism in Organic Compounds 11.4 Definition and classification of isomerism 11.5 Structural isomerism and its types: chain isomerism, position isomerism, functional isomerism, metamerism and tautomerism	**4**	**9. Alcohols** 9.1 Introduction 9.2 Nomenclature, isomerism and classification of monohydric alcohol 9.3 Preparation of monohydric alcohols from Haloalkane, primary amines, and esters 9.4 Definition of common terms: Absolute alcohol, power alcohol, denatured alcohol (methylated spirit), rectified spirit; alcoholic beverage	**3**
12. Saturated and unsaturated Hydrocarbons 12.1 Classification of hydrocarbon (alkane, alkene, alkyne) 12.2 Preparation of alkane from haloalkanes (Reduction and Wurtz reaction), from Decarboxylation, from Catalytic hydrogenation of alkene and alkyne. 12.3 Chemical properties of alkanes: substitution reactions (halogenation, nitration, and sulphonation only) 12.4 Chemical properties of alkenes: Addition reaction with HX (Markovnikov's addition and peroxide effect), H_2O, O_3, H_2SO_4 only 12.5 Chemical properties: Addition reaction with (H_2, HX, H_2O), Acidic nature (action with Sodium, ammoniacal $AgNO_3$ and ammoniacal Cu_2Cl_2)	**4**	**10. Phenols** 10.1 Introduction and nomenclature 10.2 Preparation of phenol from i. chlorobenzene ii. Diazonium salt and iii. benzene sulphonic acid 10.3 Physical properties and uses of phenol	**2**
13. Aromatic Hydrocarbons	**6**	**11 Aliphatic aldehydes and ketones**	**4**

13.1 Introduction and characteristics of aromatic compounds 13.2 Huckel's rule of aromaticity 13.3 Kekule structure of benzene 13.4 Resonance and isomerism 13.5 Preparation of benzene from decarboxylation of sodium benzoate, phenol, and ethyne only 13.6 Physical properties of benzene 13.7 Chemical properties of benzene: Addition reaction: hydrogen, halogen, Electrophilic substitution reactions: orientation of benzene derivatives (o, m & p), nitration, sulphonation, halogenations, Friedal-Craft's reaction (alkylation and acylation), combustion of benzene (free combustion only) and uses		11.1 Introduction, nomenclature and isomerism 11.2 Preparation of aldehydes and ketones from: Dehydrogenation and oxidation of alcohol, Ozonolysis of alkenes, Acid chloride, Gem dihaloalkane, Catalytic hydration of alkynes, and its uses. 11.3 Physical properties of aldehydes and ketones 11.4 Distinction between aldehyde and ketones by using 2,4- DNP reagent, Tollen's reagent, Fehling's solution 11.5 Formalin and its uses	
Content Area: Applied Chemistry			
14. Modern Chemical Manufactures **14.1 Modern Chemical Manufactures (principle and flow sheet diagram only)** 14.1.1 Manufacture of ammonia by Haber's process, 14.1.2 Manufacture of nitric acid by Ostwald's process, **14.2 Fertilizers (Chemical fertilizers, types of chemical fertilizers, production of urea with flow-sheet diagram)**	**3**	**12. Chemistry in the service of mankind** **12.1 Polymers** 12.1.1 Addition and condensation polymers 12.1.2 Elastomers and fibres 12.1.3 Natural and synthetic polymers 12.1.4 Some synthetic polymers (polythene, PVC, Teflon, polystyrene, nylon and bakelite **12.2 Drugs** 12.2.1 Characteristics of drugs 12.2.2 Natural and synthetic drugs	**4**

		12.2.3 Classification of some common drugs 12.2.4 Habit forming drugs and drug addiction **12.3 Pesticides** 12.4.1 Introduction to insecticides, herbicides and fungicides	
		13. Nuclear Chemistry and Applications of Radioactivity 13.1 Natural and artificial radioactivity 13.2 Units of radioactivity 13.3 Nuclear reactions 13.4 Nuclear fission and fusion reactions 13.5 Nuclear power and nuclear weapons 13.6 Industrial uses of radioactivity 13.7 Medical uses of radioactivity 13.8 Radiocarbon dating 13.9 Harmful effects of nuclear radiations	**5**
Total	**72**		**72**

5. Practical Portion (24 Teaching hours)

The practical work that students do during their course is aimed at providing them learning opportunities to accomplish competency of the curriculum as well as reinforcing their learning of the theoretical subject content. This part of the curriculum focuses more on skill development than knowledge building. Students must spend lots of time for working with chemical materials. Observations and investigations can enhance student learning. Project work may consist of activities designed to demonstrate the concepts and ideas through collecting, processing, analyzing and communicating data.

Students should learn to,

- collect and identify
- preserve
- test of chemicals
- draw figure, chart, preparing models, slides etc
- handle the equipment, instruments and laboratory handling with experimentation
- draw conclusion

Students should perform at least 8 experiments, either listed below or designed by teacher, so that no more than three experiments come from the same categories mentioned below.

a) List of Experiments for grade 11

A. Experiments based on laboratory techniques:

1. To separate the insoluble component in pure and dry state from the given mixture of soluble and insoluble solids (NaCl, sand and camphor).
2. To separate a mixture of two soluble solids by fractional crystallization (KNO_3 + NaCl).
3. To prepare a saturated solution of impure salt and obtain the pure crystal of the same salt by crystallization.
4. To separate the component of a mixture of two insoluble solids (one being soluble in dil. acids).
5. To obtain pure water from given sample of impure water (Distillation).

B. Experiments to study the different types of reactions (Neutralization, Precipitation, Redox reaction and Electrolysis):

6. To carry out the following chemical reactions, represent them in molecular as well as ionic forms and write the colour of the products formed:

a. Ferrous sulphate solution + ammonia solution
b. Ferric chloride solution + ammonia solution
c. Copper sulphate solution + sodium hydroxide solution (heat the mixture)
d. Copper sulphate solution + ammonia solution (add ammonia drop by drop at first and then excess)
e. Ferric chloride solution + potassium ferrocyanide solution
f. Ferrous sulphate solution + potassium ferricyanide solution
g. Copper sulphate solution + potassium iodide solution

7. To perform precipitation reaction of $BaCl_2$and H_2SO_4 and obtain solid $BaSO_4$.
8. To neutralize sodium hydroxide with hydrochloric acid solution and recover the crystal of sodium chloride.
9. To test the ferrous ions in the given aqueous solution and oxidize it to ferric ion,
   (Ferrous and Ferric ion) (Redox Reaction)
10. To study the process of electrolysis and electroplating.

C. Experiments on quantitative analysis:

11. To determine the weight of given piece of Mg by hydrogen displacement method.
12. To determine the solubility of the given soluble solid at laboratory temperature.

D. Experiments on preparation of gas and study of properties:

13. To prepare and collect hydrogen gas and study the following properties;
    a. Solubility with water, colour, odour;
    b. Litmus test;
    c. Burning match stick test; and
    d. Reducing properties of nascent hydrogen.
14. To prepare and collect ammonia gas and investigate the following properties:
    a. Solubility with water, colour and odour;
    b. Litmus test;

c. Action with copper sulphate solution phenolphathalein solution

d. Action with mercurous nitrate paper.

E. Experiments on qualitative analysis:

15. To detect the basic radical of the given salt by dry way and the acid radical by dry and wet ways in its aqueous solution.

Basic radicals: Zn^{++}, Al^{+++}, Mg^{++}, Ca^{++} ,

Acid radicals: CO_3^{--}, SO_4^{--}, NO_3^{-}, Br^{-}, I^{-}, Cl^{-}

16. To detect the presence of Cl^{-}, SO_4^{--} and CO_3^{--} in the given sample of tap water and distilled water.

b) List of Sample project works for grade 11

1. Observe in your surroundings (kitchen, school, shop, etc.) and make a possible list of organic and inorganic compounds. How are they different? Why is it necessary to study them separately, put your argument?
2. Study of the methods of purification of water.
3. Testing the hardness of drinking water from different sources and the study of cause of hardness.
4. Study of the acidity of different samples of the tea leaves.
5. Preparation of molecular models using stick and clay.
6. Study of adulteration of food materials.
7. Study of application and adverse effects of pesticides on human health.
8. Study of use and adverse effects of plastics on environment.
9. Analysis of soil samples. (elaboration need pH, humus content)
10. Investigation on corrosion and rusting on iron.

Note: Students are free to choose any topic listed in this curriculum or a topic suggested by teacher provided that it is within the theoretical contents of the syllabus. However, repetition of topic should be discouraged.

c) List of experiments for grade 12

A. Experiments based on recovery and preparation of salt

1. To recover blue vitriol crystals from the given mixture of copper sulphate and sodium chloride.

2. To recover $CaCO_3$ from the mixture of $CaCO_3$ and $MgCO_3$ (dolomite).

B. Experiments based on volumetric analysis (Titration)

3. To prepare primary standard solution of Na_2CO_3 and standardize the given acid solution (HCl) by the standard solution.

4. To determine the strength of approximate $\frac{N}{10}$NaOH solution with the help of standard decinormal solution of HCl supplied.

5. To determine the strength of bench sulphuric acid (H_2SO_4) with the help of standard NaOH or Na_2CO_3 solution and express the concentration in (i) normality (ii) molarity (iii) gm/litre (iv) percentage (Double titration).

6. To standardize the given approximate $\frac{N}{10}$ $KMnO_4$ solution with the help of primary standard oxalic solution (Redox titration).

C. Experiments based on organic chemistry:

7. To detect foreign elements present in a given organic compounds (N, S and X).

8. To identify the functional group present in the organic compounds (-OH, –CHO,–CO–,–NH_2, and –COO–)

D. Experiments based on thermochemistry:

9. To determine the enthalpy of neutralization of a strong acid and strong base.

10. To determine the molar enthalpy, change of ammonium chloride solution

E. Experiments based on chemical kinetics:

11. To study the kinetics of the reaction between sodium thiosulphate and hydrochloric acid.

12. To study the kinetics of the reaction between propanone and iodine

F. Experiments based on salt analysis:

13. To perform complete salt analysis to detect the acid and basic radicals present in the given inorganic salt (at least three salt samples).

G. Experiments based on applied and analytical Chemistry:

14. To determine the contents of acetic acid in the given volume of vinegar by titrimetric analysis.

15. To prepare some common compounds:

a. Potash alum b. Iodoform c. Fehling's solution d. Tollen's reagent

16. To demonstrate the pH value of unknown sample solutions.

d) List of sample project works for grade 12

1. Observe brick industry/chemical industry/old smoky cooking kitchen/use of chemical fertilizers/use of insecticides/ vehicular smokes, etc. and draw the conclusion of environmental impact of the chemical pollution.
2. Collect different types of plastics (or synthetic polymers) and study the effect of heat on them.
3. Preparation of soap using coconut oil or any vegetable oil.
4. Study of formation of rust in the iron nail in various conditions.
5. Study of the different types of food preservatives used in different food available in the market.
6. Investigation on the foaming capacity of different washing soaps and the effect of addition of sodium carbonate on them.
7. Study the acidic nature of alcohol and phenol.
8. Study the distinction between aliphatic aldehyde, aromatic aldehyde and aliphatic ketone.
9. Study the presence of pesticides residues in fruits and vegetables.

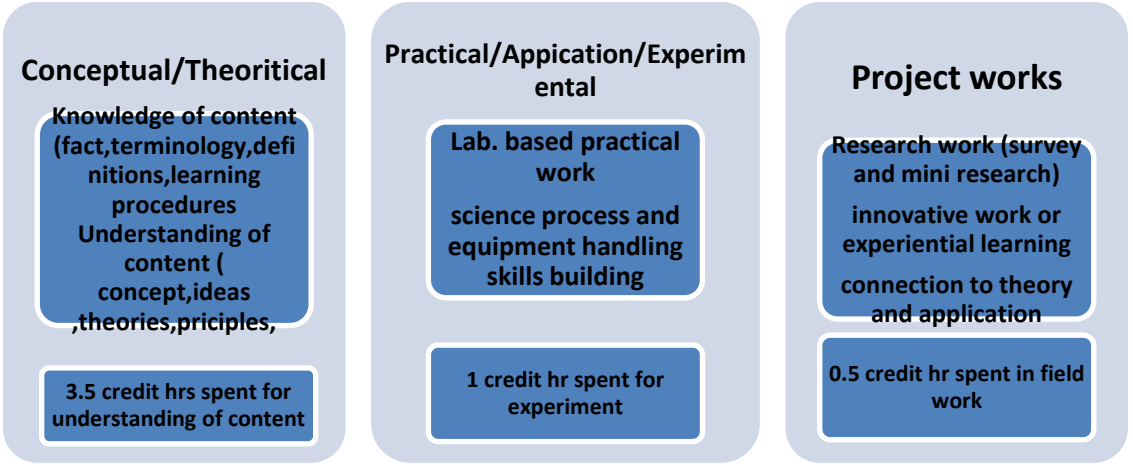
Note: Students are free to choose any topic listed in this curriculum or a topic suggested by teacher provided that it is within the theoretical contents of the syllabus. However, repetition of topic should be discouraged.

6. Learning Facilitation Process

Students should be facilitated to learn rather than just accumulation of information. Teacher plays vital role for delivering subject matters although others' role is also important. Student centered teaching-learning process is highly emphasized. Students are supposed to adopt multiple pathway of learning, such as online search, field visit, library work, laboratory work, individual and group work, research work etc. with the support of teacher. Self-study by students is highly encouraged and learning should not be confined to the scope of curriculum. Teacher should keep in mind intra and inter-disciplinary approach to teaching and learning, as opposed to compartmentalization of

knowledge. Supportive role of parents/guardians in creating conducive environment for promoting the spirit of inquiry and creativity in students' learning is anticipated.

During the delivery process of science teaching in grade 11 and 12, basically following three approaches will be adopted;



a) Conceptual/Theoretical Approach

Possible theoretical methods of delivery may include the following;

a. interaction
b. question answer
c. demonstrations
d. ICT based instructions
e. cooperative learning
f. group discussions (satellite learning group, peer group, small and large group)
g. debate
h. seminar presentation
i. Journal publishing
j. daily assignment

b) Practical/Application/Experimental approach

Practical work is the integral part of the learning science. The process of lab based practical work comprises as;

a. familiarity with objective of practical work
b. familiarity with materials, chemicals, apparatus
c. familiarity with lab process (safety, working modality etc.)

d. conduction of practical work (systematically following the given instruction)

e. analysis, interpretation and drawing conclusion

c) Project work Approach

Project work is an integral part of the science learning. Students should be involved in project work to foster self-learning of students in the both theoretical and practical contents. Students will complete project work to have practical idea through learning by doing approach and able to connect the theory into the real-worldcontext. It is regarded as method/ process of learning rather than content itself. So use of project work method to facilitate any appropriate contents of this curriculum is highly encouraged.

In this approach student will conduct at least one **research work, or an innovative work** under the guidance of teacher, using the knowledge and skillslearnt. It could include any of the followings;

(a) Mini research

(b) Survey

(c) Model construction

(d) Paper based work

(e) Study of ethno-science

General process of research work embraces the following steps;

a. Understanding the objective of the research

b. Planning and designing

c. Collecting information

d. Analysis and interpretation

e. Reporting /communicating (presentation, via visual aids, written report, graphical etc.)

General process of innovative work embraces the following steps;

a. Identification of innovative task (either assigned by teacher or proposed by student)

b. Planning

c. Performing the task

d. Presentation of the work

e. Record keeping of the work

Students are free to choose any topic listed in this curriculum or a topic suggested by teacher provided that it is within the theoretical contents of the Curriculum. However, repetition of topic should be discouraged.

Learning process matrix

Knowledge and understanding	Scientific skills and process	Values, attitudes and application to daily life
• Scientific phenomenon, facts, definition, principles, theory, concepts and new discoveries • Scientific vocabulary, glossary and terminology • Scientific tools, devises, instruments apparatus • Techniques of uses of scientific instruments with safety • Scientific and technological applications	• Basic and integrated scientific process skills <u>Process</u> • Investigation • Creative thinking • problem solving	• Responsible • Spending time for investigation

Basic Science Process Skills includes,

1. Observing:Using senses to gather information about an object or event. It is description of what was actually perceived.
2. Measuring: Comparing unknown physical quantity with known quantity (standard unit) of same type.
3. Inferring:Formulating assumptions or possible explanations based upon observations.
4. Classifying:Grouping or ordering objects or events into categories based upon characteristics or defined criteria.

5. Predicting:Guessing the most likely outcome of a future event based upon a pattern of evidence.
6. Communicating: using words, symbols, or graphics to describe an object, action or event.

Integrated Science Process Skills includes,

1. Formulating hypotheses:Determination of the proposed solutions or expected outcomes for experiments. These proposed solutions to a problem must be testable.
2. Identifying of variables: Identification of the changeable factors (independent and dependent variables) that can affect an experiment.
3. Defining variables operationally: explaining how to measure a variable in an experiment.
4. Describing relationships between variables**:** explaining relationships between variables in an experiment such as between the independent and dependent variables.
5. Designing investigations: designing an experiment by identifying materials and describing appropriate steps in a procedure to test a hypothesis.
6. Experimenting: carrying out an experiment by carefully following directions of the procedure so the results can be verified by repeating the procedure several times.
7. Acquiring data: collecting qualitative and quantitative data as observations and measurements.
8. Organizing data in tables and graphs: presenting collected data in tables and graphs.
9. Analyzing investigations and their data: interpreting data, identifying errors, evaluating the hypothesis, formulating conclusions, and recommending further testing where necessary.
10. Understanding cause and effect relationships: understanding what caused what to happen and why.
11. Formulating models: recognizing patterns in data and making comparisons to familiar objects or ideas.

7. Student Assessment

Evaluation is an integral part of learning process. Both formative and summative modes of evaluation are emphasized. Formative evaluation will be conducted so as to provide regular feedback for students, teachers and parents/guardians about how student learning is. Class tests, unit tests, oral question-answer, home assignment etc., are some ways of formative evaluation.

There will be separate evaluation of theoretical and practical learning. Summative evaluation embraces theoretical examination, practical examination and evaluation of research work or innovative work.

(a) Internal Evaluation

Out of 100 full marks Internal evaluation covers 25 marks. Internal evaluation consists of Practical work (16 marks), (b) Marks from trimester examinations (6 marks), and (c) Classroom participation (3 marks)

- **Practical Activities**

Practical works and project works should be based on list of activities mentioned in this curriculum or designed by teacher. Mark distribution for practical work and project work will be as follows:

S.N.	Criteria	Elaboration of criteria	Marks
1.	Laboratory experiment	Correctness of apparatus setup/preparation	2
		Observation/Experimentation	2
		Tabulation	1
		Data processing and Analysis	1
		Conclusion (Value of constants or prediction with justification)	1
		Handling of errors/precaution	1
2.	Viva-voce	Understanding of objective of the experiment	1
		Skills of the handling of apparatus in use	1
		Overall impression	1
3.	Practical work records and attendance	Records (number and quality)	2

4	Project work	Reports (background, objective, methodology, finding, conclusion	2
		Presentation	1
		Total	**16**

Note:

(i) Practical examination will be conducted in the presence of internal and external supervisors. Evaluation of laboratory experiment will focus both the product of work and skills competencies of student in using apparatus.

(ii) Project work assessment is the internal assessment of reports and presentation of their project works either individually or group basis. In case of group presentation, every member of the group should submit a short reflection on the presented report in their own language. Records of project works must be attested by external supervisor.

- **Marks from trimester examinations**
  Total of 6 marks, 3 marks from each trimester.
- **Classroom participation (3 marks)**

Classroom participation includes attendance (1) and participation in learning (2).

(b) External Evaluation

Out of 100 marks theoretical evaluation covers 75 marks. The tool for external evaluation of theoretical learning will be a written examination. Questions for the external examination will be based on the specification grid developed by Curriculum Development Centre. Examination question paper will be developed using various levels of revised Bloom's taxonomy including remembering level, understanding level, application level and higher ability (analyzing, evaluating, creating).

Specification Grid

Grade : 11 **Subject : Chemistry** Time: 3 hrs.

S.N.	Area	Working hour	Competency level				Area wise Score
			Knowledge/ Remembering	Understanding	Applying	Higher Ability	
1	**Physical chemistry**	32	MCQ (2x1) SQ (2x5)	MCQ (5 x1) SQ (1x5) LQ (1x8)	MCQ (3x1) SQ (2x5) LQ (1x8)	MCQ (1x1) SQ (3x5) LQ (1x8)	33
2	**Inorganic chemistry**	17					18
3	**Organic chemistry**	20					21
4	**Applied chemistry**	3					3
	Total	**72**	**12**	**18**	**21**	**24**	**75**

Item format plan

	Type of item	Score per item	Number of items				Total item	Total Score
1	Multiple Choice Questions	1	2	5	3	1	11	11
2	Short Question Answer	5	2	1	2	3	8	40
3	Long Question Answer	8	0	1	1	1	3	24
	Grand Total		**4**	**7**	**6**	**5**	**22**	**75**

Grade : 12

S.N.	Area	Working hour	Competency level				Area wise Score
			Knowledge/ Remembering	Understanding	Applying	Higher Ability	
1	Physical chemistry	35	MCQ (2x1)	MCQ (5 x1)	MCQ (3x1)	MCQ (1x1)	36

2	Inorganic chemistry	15	SQ (2x5)	SQ (1x5)	SQ (2x5)	SQ (3x5)	16
3	Organic chemistry	13					14
4	Applied chemistry	9		LQ (1x8)	LQ (1x8)	LQ (1x8)	9
Total		**72**	**12**	**18**	**21**	**24**	**75**

Item format plan

	Type of item	Score per item	Number of items				Total item	Total Score
1	Multiple Choice Questions	1	2	5	3	1	11	11
2	Short Question Answer	5	2	1	2	3	8	40
3	Long Question Answer	8	0	1	1	1	3	24
Grand Total			**4**	**7**	**6**	**5**	**22**	**75**

Remarks:

- Item format in composite should be met as per the specification grid.
- ±2 marks variation will be allowed within the area. But cannot be nil.
- In case of 5 or 8 marks items, these should ensure that 1 mark will be assigned per element expected as correct response. However, cognitive behavior intended might not be single behavior within the item. But in total cognitive distribution should met. ±2 marks variation will be allowed within the cognitive levels.
- SQ and LQ can be structured (have two or more sub-items). SQ and LQ can be distributed to two or more cognitive behaviors. In such case these will be added to their respective cognitive behavior. In sum the distribution of cognitive behavior should be approximately to the required distribution.
- The distribution of questions based on cognitive domain will be nearby 15% knowledge/remembering, 25% understanding, 30% applying and 30% higher ability level.
- In case of short question there will be 2"OR" questions and in case of long question there will be 1 "OR" question.

Technical and Vocational Stream

Secondary Education Curriculum

Physics

Grade: 11 and 12 **Credit hour: 3** **Working hour: 96**

1. Introduction

This curriculum presumes that the students joining grade 11 and 12 science stream come with diverse aspirations, some may continue to higher level studies in specific areas of science, others may join technical and vocational areas or even other streams. The curriculum is designed to provide students with general understanding of the fundamental scientific laws and principles that govern the scientific phenomena in the world. It focuses to develop scientific knowledge, skill competences and attitudes required at secondary level (grade 11-12) irrespective of what they do beyond this level, as envisioned by national goals. Understanding of scientific concepts and their application, in day to day context as well as the process of obtaining new knowledge through holistic approach of learning in the spirit of national qualification framework is emphasized in the curriculum.

In particular, this curriculum aims to provide sufficient knowledge and understanding of science for all learners to become confident citizens in the technological world. It helps the students to recognize the usefulness and limitations of laws and principles of physics and use them in solving problems encountered in their daily lives along a sound foundation for students who wish to study physics or related professional or vocational courses in higher education. It also helps to develop science related attitudes such as a concern for safety and efficiency, concern for accuracy and precision, objectivity, a spirit of enquiry, inventiveness, appreciation of ethno-science, and willingness to use technology for effective communication. It also promotes awareness of the principles and laws of science that are often the result of cumulative efforts and their studies and applications are subject to economic and technological limitations and social, cultural and ethical perceptions/acceptance.

The curriculumprepared in accordance with National Curriculum Framework is structured for two academic years in such a way that it incorporates the level-wise

competencies, grade-wise leaning outcomes, scope and sequence of contents, suggested practical/project activities, learning facilitation process and assessment strategies so as to enhance the learning on the subject systematically.

2. Level-wise competencies

In completion of this course, students are expected to demonstrate the following competencies:

1. Relatethe phenomena and processes of the world around them tothe knowledge and understanding of physical laws, principles and theories and describe them using appropriate scientific vocabulary, terminology and conventions
2. Use scientific instruments, apparatus and methods to collect, evaluate and communicate informationaccurately and precisely
3. Design simple experiment to develop relations among physical quantities,
4. Carryout simple scientific research on issues related to physics and
5. Construct simple models to illustrate physical concepts
6. Use the knowledge of physics to promote care for the environment, indigenous knowledge, social values and ethics.

3. Grade wise learning Outcomes

Grade 11	Grade 12
Content Area: Mechanics	
1. Physical Quantities 1.1 Demonstrate the meaning, importance and applications of precision in the measurements 1.2 Understand the meaning and importance of significant figures in measurements 1.3 Explain the meaning of dimensions of a physical quantity 1.4 Apply dimensional analysis method to check the homogeneity of physical equations	**1. Rotational dynamics** 1.1 Recall equations of angular motion and compare them with equations of linear motion 1.2 Derive the expression for rotational kinetic energy 1.3 Describe the term moment of inertia and radius of gyration 1.4 Find the moment of inertia of thin uniform rod rotating about its center and its one end 1.5 Describe the work and power in rotational motion with expression 1.6 Define angular momentum and prove the principle of conservation of angular momentum 1.7 Solve numerical problems and conceptual questions regarding the rotational dynamics
2. Vectors 2.1 Distinguish between scalar and vector quantities 2.2 Add or subtract coplanar vectors by drawing scale diagram (vector triangle, parallelogram or polygon method) 2.3 Describe scalar and vector products 2.4 Understand the meaning and applications of scalar and vector product with examples	**2. Periodic motion** 2.1 Define simple harmonic motion and state its equation. 2.2 Derive the expressions for energy in simple harmonic motion 2.3 Derive the expression for period for vertical oscillation of a mass suspended from coiled spring

2.5 Solve related problems.	2.4 Derive expression for period of simple pendulum 2.5 Solve the numerical problems and conceptual questions regarding the periodic motion
3. Kinematics 3.1 Explain and use the concept of relative velocity 3.2 Establish equations for a uniformly accelerated motion in a straight line from graphical representation of such motion and use them to solve related numerical problems 3.3 Write the equations of motion under the action of gravity and solve numerical problem related to it 3.4 Understand projectile motion as motion due to a uniform velocity in one direction and a uniform acceleration in a perpendicular direction, derive the equations for various physical quantities (maximum height, time of flight, time taken to reach maximum height, horizontal range, resultant velocity) and use them to solve mathematical problems related to projectile motion	**3. Fluid statics** 3.1 Define up-thrust, pressure in fluid, buoyancy, center of buoyancy and meta center 3.2 Describe surface tension and explain its principle 3.3 State Stoke's law and use it to determine the coefficient of viscosity of given liquid 3.4 Solve the numerical problems and conceptual questions regarding the fluid statics
4. Dynamics: 4.1 Define linear momentum, impulse, and establish the relation between them 4.2 Define and use force as rate of change of momentum 4.3 State and prove the principle of conservation of linear momentum using Newton's second and Newton's third of motion	-

4.4 Define and apply moment of a force and torque of a couple 4.5 Solve the numerical problem and conceptual question on dynamics	
5. Work, energy and power: 5.1 Explain work done by a constant force and a variable force 5.2 State and prove work-energy theorem 5.3 State and prove the principle of conservation of energy 5.4 Differentiate between conservative and non-conservative force 5.5 Solve the numerical problems and conceptual questions regarding work, energy, power and collision	-
6. Circular motion 6.1 Define angular displacement, angular velocity and angular acceleration 6.2 Establish the relation between angular and linear velocity & acceleration 6.3 Define centripetal force and centripetal acceleration 6.4 Solve the numerical problem	-
7. Gravitation 7.1 Explain Newton's law of gravitation 7.2 Define gravitational field strength 7.3 Define and derive formula of gravitational potential and	-

gravitational potential energy 7.4 Define escape velocity and derive the expression of escape velocity 7.5 Define and derive the expression for orbital velocity and time period of a satellite 7.6 Solve the numerical problem	
8. Elasticity 8.1 State and explain Hooke's law 8.2 Define the terms stress, strain, elasticity and plasticity 8.3 Define the types of elastic modulus such as young modulus, bulk modulus and shear modulus 8.4 Derive the expression for energy stored in a stretched wire 8.5 Solve the numerical problems and conceptual questions regarding elasticity	-
Content Area: Heat and thermodynamics	
9. Heat and temperature 9.1 Explain the molecular concept of thermal energy, heat and temperature, and cause and direction of heat flow 9.2 Explain the meaning of thermal equilibrium and Zeroth law of thermodynamics.	**4. First Law of Thermodynamics** 4.1 Clarify the concept of thermodynamic system. 4.2 Explain the meaning of work done by the system and work done on the system, and describe how work done by gas during expansion can be calculated from indicator (P – V) diagram. 4.3 Define and explain two specific heat capacities of gas appreciating the relation Cp – Cv = R and cp – cv = r.

10. Thermal Expansion 10.1 Explain some examples and applications of thermal expansion, and demonstrate it with simple experiments. 10.2 Explain linear, superficial, cubical expansion and define their corresponding coefficients with physical meaning. 10.3 Establish a relation between coefficients of thermal expansion. 10.4 Explain real and apparent expansion of liquid appreciating the relation $\gamma r = \gamma g + \gamma a$. 10.5 Solve mathematical problems related to thermal expansion.	
11. Quantity of Heat 11.1 Define heat capacity and specific heat capacity and explain application of high specific heat capacity of water and low specific heat capacity of cooking oil and massage oil 11.2 Describe Newton's law of cooling with some suitable daily life examples. 11.3 Explain the meaning of latent heat of substance appreciating the graph between heat and temperature and define specific latent heat of fusion and vaporization. 11.4 Distinguish evaporation and boiling. 11.5 Define triple point. 11.6 Solve mathematical problems related to heat	-
12. Rate of heat flow	-

12.1 Explain the transfer of heat by conduction, convection and radiation with examples and state their applications in daily life. 12.2 Define temperature gradient and relate it with rate of heat transfer along a conductor. 12.3 Explain ideal radiator (e= 1, a =1) and black body radiation. 12.4 State and explain Stefan's law of black body radiation using terms; emissive power and emissivity. 12.5 Solve mathematical problems related to thermal conduction and black body radiations.	
Content Area : Wave and Optics	
13. Reflection at curved mirrors 13.1 State the relation between object distance, image distance and focal length of curved mirrors 13.2 State the relation between object size and image size 13.3 Calculate the focal length of curved mirrors and its applications	**5. Wave motion** 5.1 Define and understand progressive wave 5.2 Write progressive wave in mathematical form 5.3 Discuss the condition under which stationary waves can be formed 5.4 Write stationary wave in mathematical form 5.5 Calculate frequency, amplitude, velocity, time periodetc of progressive wave
14. Refraction at plane surfaces 14.1 Recall the laws of refraction 14.2 Understand the meaning of lateral shift	**6. Mechanical waves** 6.1 Calculate Speed of wave motion 6.2 Describe Velocity of sound in gas 6.3 Describe Laplace correction

	6.4 Formulate the effect of temperature, pressure, humidity on velocity of sound and their physical meaning
15. Refraction through prisms: 15.1 Understand minimum deviation condition 15.2 Discuss relation between angle of prism, angle of minimum deviation and refractive index 15.3 Understand deviation in small angle prism and learn its importance in real life	**7. Wave in pipes and strings** 7.1 Understand the formation of stationery waves in closed and open pipes 7.2 Define and understand harmonics and overtones 7.3 State and use the formula for velocity of transverse waves along a stretched string
16. Lenses 16.1 State properties of Spherical lenses 16.2 State the relation between object distance, image distance and focal length of a convex lens 16.3 Define visual angle and angular magnification 16.4 Derive Lens maker's formula and use it to find focal length	**8. Acoustic phenomena:** 8.1 Describe sound waves as pressure waves in a medium 8.2 Characterize the sound using its intensity, loudness, quality and pitch 8.3 Discuss Doppler's effect 8.4 Apply Doppler effect in realistic case where source and observers are in relative motion.
17. Dispersion 17.1 Understand pure spectrum 17.2 Discuss chromatic and spherical aberration 17.3 Discuss achromatism in lens and its applications	
-	**9. Interference** 9.1 Explain the Phenomenon of Interferences

	9.2 Understand the meaning of coherent sources 9.3 Describe Young's double slit experiment and obtain the expression for nth order maxima **Diffraction** 9.4 Describe diffraction at single slit 9.5 Understand diffraction pattern of image 9.6 Explain diffraction through diffraction grating 9.7 Explain the resolving power of optical instrument
-	**Polarization** 9.8 Describe phenomenon of polarization 9.9 Polaroids and their applications. 9.10 State and use Brewster's law
Content Area: Electricity and Magnetism	
18. Electric charges 18.1 Understand the concept of electric charge and charge carriers 18.2 Understand the process of charging by friction and use the concept to explain related day to day observations 18.3 Understand that, for any point outside a spherical conductor, the charge on the sphere may be considered to act as a point charge at its centre 18.4 State Coulomb's law 18.5 Compute the magnitude and direction of the net force	**10. Electrical circuits** 10.1 Understand Kirchhoff's law and use to calculate unknown parameters in electrical circuits 10.2 Describe the circuit diagram of Wheatstone bridge circuit and its Importance 10.4 Describe meter bridge and understand it 10.5 Know construction, working and importance of potentiometer

acting at a point due to multiple charges	10.6 Distinguish between perfect conductors and super conductors 10.7 learn the technique to convert galvanometer into voltmeter and ammeter 10.8
19. Electric field: 19.1 Describe an electric field as a region in which an electric charge experiences a force 19.2 Define electric field strength as force per unit positive charge acting on a stationary point charge 19.3 Calculate forces on charges in uniform electric fields of known strength 19.4 Use $E = \frac{Q}{4\pi\varepsilon_o r^2}$ strength of a point charge in free space or air 19.5 Understand the concept of electric flux of a surface 19.6 State Gauss law and apply it for a field of a charged sphere and for line charge	**11. Magnetic properties of materials:** 11.1Define relative permeability and relative susceptibility of a magnetic material 11.2 Discuss relationship between relative permeability and susceptibility 11.3 Discuss Hysteresis of ferromagnetism 11.4Understand Dia,-para- and ferro-magnetic materials
20. Potential, potential difference and potential energy 20.1 Define potential at a point as the work done per unit positive charge in bringing a small test charge from infinity to the point 20.2 Use electron volt as a unit of electric potential energy 20.3 Recall and use $V = \frac{Q}{4\pi\varepsilon_o r}$ for the potential in the field of a	**12. Magnetic field** 12.1 Show understanding of the concept of magnetic field lines and magnetic flux and sketch magnetic field lines around a straight current carrying conductor and long solenoid 12.2 Explain Oersted's experiment, its outcome and limitations

point charge	12.3 Discuss force on moving charge in uniform magnetic field 12.4 Discuss force on a current carrying conductor placed in uniform magnetic field 12.5 Describe moving coil galvanometer and know its applications 12.6 Explain Hall effect and derive the expression VH=BI/ntq where t is thickness 12.7 State Biot and Savart law and know its application on (i) a circular coil (ii) a long straight conductor (iii) a long solenoid
21. Capacitor **21.1 capacitance and capacitor** a. Show understanding of the uses of capacitors in simple electrical circuits b. Define capacitance as the ratio of the change in an electric charge in a system to the corresponding change in its electric potential and associate it to the ability of a system to store charge c. Use $C = \frac{Q}{V}$ **21.2 Parallel plate capacitor** a. Derive $C = \frac{\varepsilon_o A}{d}$, using Gauss law and $C = \frac{Q}{V}$, for parallel plate capacitor	**13. Alternating Currents:** 13.1 Understand peak and rms value of AC current and voltage 13.2 Discuss AC through a resistor, a capacitor and an inductor 13.3 Understand Phasor diagram in RC and RL circuits 13.4 Describe series resonance condition and know its applications 13.5 Understand the meaning of quality factor 13.6 Discuss power in AC circuits and know the term power factor 13.7 Solve the numerical problems.

b. Explain the effect on the capacitance of parallel plate capacitor of changing the surface area and separation of the plates **21.3 Combination of capacitors** a. Derive formula for combined capacitance for capacitors in parallel combinations b. Solve problems related to capacitors in parallel combinations	
22. DC Circuits **22.1 Electric Currents; Drift velocity and its relation with current** a. Understand the concept that potential difference between two points in a conductor makes the charge carriers drift b. Define electric current as the rate of flow of positive charge, $Q = It$ c. Derive, using $Q=It$ and the definition of average drift velocity, the expression $I=nAVd$where n is the number density of free charge carriers **22.2 Ohm's law Ohm's law; Electrical Resistance: resistivity and conductivity** a. Define and apply electric resistance as the ratio of potential difference to current b. Define *ohm* ,*resistivity* and *conductivity* *c.* Use $R = \rho l$ /A for a conductor	

d. Explain, using $R = \rho l$ /A, howchanges in dimensions of a conducting wire works as a variable resistor **22.3 Current-voltage relations: ohmic and non-ohmic** a. Sketch and discuss the I–V characteristics of a metallic conductor at constant temperature, a semiconductor diode and a filament lamp d) state Ohm's law b. State Ohm's law and identify ohmic and non-ohmic resistors **22.4 Resistances in series and parallel** a. Derive, using laws of conservation of charge and conservation of energy, a formula for the combined resistance of two or more resistors in parallel b. Solve problems using the formula for the combined resistance of two or more resistors in series **22.5 Potential divider** a. Understand the principle of a potential divider circuit as a source of variable pS.d. and use it in simple circuits b. Explain the use of sensors (thermistors, light-dependent resistors and strain gauges) in potential divider circuit as a source of potential difference that is dependent on temperature, illumination and strain respectively **22.6 Electromotive force of a source, internal resistance** a. Define electromotive force (e.m.f.) in terms of the energy transferred by a source in driving unit charge round a complete circuit	

b. Distinguish between e.m.f. and potential difference (p.d.) in terms of energy considerations c. Understand the effects of the internal resistance of a source of e.m.f. on the terminal potential difference	
Content Area: Modern Physics	
23. Nuclear physics 23.1 Explain how nucleus was discovered 23.2 Convey the meaning of mass number, atomic number 23.3 Calculate the expression of nuclear density 23.4 Explain the existence of different isotopes of the same element 23.5 Describe main theme of Einstein's mass energy relation and state the relation 23.6 Explain the meaning of mass defect and cause of it 23.7 Describe the terms creation and annihilation 23.8 Derive the relation of binding energy and binding energy per unit nucleon of different nuclei 23.9 Plot a graph between BE per nucleon and mass number of different nuclei 23.10 Define nuclear fusion and fission and explain the mechanism of energy release 23.11 Solve numerical problems related to nuclear physics	**14. Electrons** 14.1 Describe Millikan's oil drop experiment and explain how it suggests quantization of charge 14.2 Describe the motion of electrons in electric and magnetic fields and derive appropriate mathematical expressions 14.3 Describe J.J Thomson's experiment with suitable diagrams to explain the discovery of electron and its characters 14.4 Solve numerical problems related to above topics
	15. Photons

	15.1 Describe quantum nature of radiation 15.2 Describe work function and photoelectric effect 15.3 Derive Einstein's photoelectric equation 15.4 Describe Millikan's experiment for the verification of Einstein's photoelectric equation and calculate Planck's constant 15.5 Solve some related problems
	16. Semiconductor devices 16.1 Describe the formation of PN junction and semiconductor diode 16.2 Plot forward and reverse characteristics of semiconductor diode including the concept of Zener diode 16.3 Define rectifier 16.4 Describe full wave rectification using semiconductor diodes 16.5 Define logic gates and explain operation of different logic gates OR, AND, NOT, NAND and NOR gates with their symbol , Boolean algebra and truth table
-	**17. Quantization of energy** 17.1 Differentiate excitation and ionization potentials 17.2 Explain emission and absorption spectra 17.3 Define x-rays 17.4 Describe modern Coolidge tube method for the production of x-rays with quality and quantity

	17.5 Illustrate different properties of x-rays along with their applications 17.6 Solve numerical problems related to quantization of energy

4. Scope and Sequence of Contents

Grade 11		Grade 12	
Contents	**T H**	**Contents**	**T H**
Content Area: Mechanics			
1. Physical Quantities **1.1.** Precision and significant figures. Dimensions and uses of dimensional analysis.	**3**	**1. Rotational dynamics** 1.1 Equation of angular motion, Relation between linear and angular kinematics 1.2 Kinetic energy of rotation of rigid body 1.3 Moment of inertia; Radius of gyration 1.4 Moment of inertia of a uniform rod 1.5 Torque and angular acceleration for a rigid body 1.6 Work and power in rotational motion 1.7 Angular momentum, conservation of angular momentum.	**7**
2. Vectors 2.1. Triangle, parallelogram and polygon laws	**4**	2. **Periodic motion** 2.1 Equation of simple harmonic motion	**6**

of vectors 2.2. Resolution of vectors; Unit vectors 2.3. Scalar and vector products.		(SHM) 2.2 Energy in SHM 2.3 Application of SHM: vertical oscillation of mass suspended from coiled spring, simple pendulum 2.4 Oscillatory motion: Damped oscillation, Forced oscillation and resonance.	
3. Kinematics 3.1 Instantaneous velocity and acceleration 3.2 Relative velocity 3.3 Equation of motion (graphical treatment) 3.4 Motion of a freely falling body 3.5 Projectile motion and its applications.	**4**	**3. Fluid statics** 3.1 Fluid statics: Pressure in a fluid; Buoyancy 3.2 Surface tension: Theory of surface tension; Surface energy 3.3 Angle of contact, capillarity and its applications 3.4 Stokes law and its applications	**5**
4. Dynamics 4.1 Linear momentum, Impulse 4.2 Conservation of linear momentum 4.3 Application of Newton's laws 4.4 Moment, torque and equilibrium 4.5 Centre of mass and center of gravity	**4**	-	
5. Work, energy and power	**2**	-	

5.1 Work done by a constant force and a variable force 5.2 power 5.3 Work-energy theorem; Kinetic and potential energy 5.4 Conservation of Energy 5.5 Conservative and non-conservative forces			
6. Circular Motion 6.1 Angular displacement, velocity and acceleration 6.2 Relation between angular and linear velocity and acceleration 6.3 Centripetal acceleration 6.4 Centripetal force	**3**	-	
7. Gravitation 7.1 Newton's law of gravitation 7.2 Gravitational potential; Gravitational potential energy 7.3 Motion of a satellite: Orbital velocity and time period of the satellite 7.4 Escape velocity	**3**	-	
8. Elasticity	**4**	-	

8.1 Hooke's law: Force constant 8.2 Stress; Strain; Elasticity and plasticity 8.3 Elastic modulus: Young modulus, bulk modulus, shear modulus 8.4 Poisson's ratio 8.5 Elastic potential energy.			
Content Area: Heat and Thermodynamics			
9. Heat and Temperature 10.1 Molecular concept of thermal energy, heat and temperature, and cause and direction of heat flow 10.2 Meaning of thermal equilibrium and Zeroth law of thermodynamics.	**2**	**4. First Law of Thermodynamics** 4.1 Thermodynamic systems 4.2 Internal energy and First law of thermodynamics 4.3 Heat capacities of an ideal gas at constant pressure and volume and relation between them	**2**
10. Thermal Expansion 10.1 Linear expansion, coefficient of linear expansion and its measurement 10.2 Superficial expansion and coefficient of superficial expansion 10.3 Cubical expansion and coefficient of cubical expansion 10.4 Relation among coefficient of linear expansion, superficial expansion and cubical expansion	**3**		
11. Quantity of Heat	**3**		

11.1 Newton's law of cooling 11.2 Measurement of specific heat capacity of solids and liquids 11.3 Specific latent heat of fusion and vaporization 11.4 Triple point			
12. Rate of heat flow 12.1 Conduction: Thermal conductivity and measurement 12.2 Convection 12.3 Radiation: Black- body radiation 12.4 Stefan – Boltzmann law.	**3**	-	
Content Area: Waves & Optics			
13. Reflection at curved mirror 13.1 Real and Virtual images. 13.2 Mirror formula	**2**	**5. Wave motion** 5.1 Progressive waves 5.2 Mathematical description of a wave 5.3 Stationary waves	**2**
14. Refraction at plane surfaces 14.1 Laws of refraction: Refractive index 14.3 Lateral shift	**1**	**6. Mechanical waves** 6.1 Speed of wave motion; Velocity of sound in solid and liquid 6.2 Velocity of sound in gas 6.3 Effect of temperature, pressure, humidity	**3**

		on velocity of sound.	
15. Refraction through prisms 15.1 Minimum deviation condition 15.2 Relation between Angle of prism, minimum deviation and refractive index 15.3 Deviation in small angle prism.	**3**	**7. Wave in pipes and strings** 7.1 Stationary waves in closed and open pipes 7.2 Harmonics and overtones in closed and open organ pipes 7.3 Velocity of transverse waves along a stretched string	**3**
16. Lenses 16.1 Spherical lenses, angular magnification 16.2 Lens maker's formula 16.3 Power of a lens	**3**	**8. Acoustic phenomena** 8.1 Sound waves: Pressure amplitude 8.2 Characteristics of sound: Intensity; loudness, quality and pitch 8.3 Doppler's effect.	**4**
17. Dispersion 17.1 Pure spectrum and dispersive power 17.2 Chromatic and spherical aberration 17.3 Achromatism and its applications	**3**	**9. Wave Nature of light** 9.1 Interference 9.1.1 Phenomenon of Interferences: Coherent sources 9.1.2 Young's double slit experiment. 9.2 Diffraction 9.2.1 Diffraction from a single slit 9.2.2 Diffraction pattern of image; Diffraction grating 9.2.3 Resolving power of optical instruments.	**3**

		9.3 Polarization 9.3.1 Phenomenon of polarization 9.3.2 Polaroid	
Content Area: Electricity & Magnetism			
18. Electric Charges 18.1 Electric charges Charging by induction 18.3 Coulomb's law- Force between two point charges 18.4 Force between multiple electric charges.	**3**	**10. Electrical circuits** 10.1 Kirchhoff's law 10.2 Wheatstone bridge circuit; Meter bridge 10.3 Potentiometer: Comparison of e.m.f., measurement of internal resistances of a cell 10.4 Super conductors; Perfect conductors 10.5 Conversion of galvanometer into voltmeter and ammeter; Ohmmeter 10.6 Joule's law	**6**
19. Electric field 19.1 Electric field due to point charges; Field lines 19.2 Gauss Law: Electric Flux 19.3 Application of Gauss law: Field of a charge sphere, line charge, charged plane conductor	**3**	**11. Magnetic properties of materials:** 11.1 Magnetic field lines and magnetic flux 11.2 Flux density in magnetic material; Relative permeability; Susceptibility 11.3 Hysteresis 11.4 Dia,-para- and ferro-magnetic materials.	**5**
20. Potential, potential difference and potential energy 20.1 Potential due to a point charge, Potential	**2**	**12. Magnetic field** 12.1 Force on moving charge; Force on a conductor	**4**

difference, potential energy, electron volt 20.2 Potential gradient		12.2 Force and Torque on rectangular coil, Moving coil galvanometer 12.3 Magnetic field of a moving charge 12.4 Biot and Savart law and its application to (i) a circular coil (ii) a long straight conductor (iii) a long solenoid	
21. Capacitor 21.1 Capacitance and capacitor 21.2 Combination of capacitors 22.4 Energy of charged capacitor	**3**	**13. Alternating Currents** 13.1 Peak and rms value of AC current and voltage 13.2 AC through a resistor, a capacitor and an inductor 13.3 Phasor diagram 13.4 Series circuits containing combination of resistance, capacitance and inductance 13.5 Power in AC circuits: power factor	**5**
22. DC Circuits 22.1 Electric Currents; Drift velocity and its relation with current 22.2 Ohm's law; Electrical Resistance; Resistivity; Conductivity 22.3 Resistances in series and parallel, 22.4 Potential divider	**7**		

22.5 Electromotive force of a source, internal resistance 22.6 Electrical power			
Content Area : Modern Physics			
23. Nuclear physics 23.1 Atomic number, Nucleon number, Isotopes 22.4 Einstein's mass-energy relation 22.5 Mass Defect, BE per nucleon 22.6 Nuclear fission and fusion, energy released 23.4 Creation and annihilation	**4**	**14. Electrons** 14.1 Milikan's oil drop experiment, 14.2 Motion of electron beam in electric and magnetic fields 14.3 Thomson's experiment to determine specific charge of electrons	**4**
		15. Photons 15.1 Quantum nature of radiation 15.2 Einstein's photoelectric equation; Stopping potential 15.3 Measurement of Plank's constant	**3**
		16. Semiconductor devices 16.1 Semiconductor- intrinsic and extrinsic 16.2 P-N Junction 16.3 Semiconductor diode: Characteristics in forward and reverse bias 16.4 Full wave rectification 16.5 Logic gates; NOT, OR, AND, NAND and	**6**

		NOR.	
-		**17. Quantization of energy** 17.1 Spectral series; Excitation and ionization potentials 17.2 Energy level; Emission and absorption spectra 17.3 De Broglie Theory; Duality 17.4 X-rays: Nature and uses	**4**
Total-	**72**		**72**

5. Practical Courses [24 Hours]

The practical work that students do during their course is aimed at providing them learning opportunities to accomplish competency number 2 and 3 of the syllabus as well as reinforcing their learning of the theoretical subject content. This part of the syllabus focuses more on skill building than knowledge building. Students must be aware of the importance of precision, accuracy, significant figures, range and errors while collecting, processing, analyzing and communicating data. Likewise, graphical method of analysis and drawing conclusion should be encouraged wherever possible.

Students should

1. learn to use metre rule for measuring length, Vernier-calipers for measuring small thicknesses, internal and external diameters of cylindrical objects and depths of holes, spherometer for measuring radius of curvature of spherical surfaces and micrometer screw-gauge for measuring diameter of small spherical or cylindrical objects and very small thicknesses, traveling microscope with Vernier scale for measuring small distances, top-pan balance for measuring small masses, stop watch for measuring time interval, laboratory thermometer for measuring temperature, protractor for measuring angle), ammeter and milli-ammeter for measuring electric current and voltmeter for measuring electric potential difference.
2. learn to measure precisely up to the least count of the measuring instrument-

metre rule – 0.001m or 1 mm

Vernier calipers - 0.1 mm

Spherometer - 0.01 mm

micrometer screw gauge - 0.01 mm

stop watch - 0.01s

laboratory thermometer - $0.5^{o}C$

protractor - 1^{o}

3. learn to repeat readings and take the average value
4. learn to draw a standard table, with appropriate heading and unit for every column for storing data

5. learn to plot a graph using standard format, draw suitable trend lines, determine gradient, intercepts and area and use them to draw appropriate conclusion
6. learn to estimate and handle uncertainties.

In each academic year, students should perform 8 experiments, either listed below or designed by teacher, so that no more than three experiments come from the same unit of this syllabus.

a) Practical Activities for Grade 11

I. Mechanics

1. Verify the law of moments by graphically analyzing the relation between clockwise moment and anticlockwise moment on a half metre rule suspended at the certre by a string.
2. Determination of Young modulus of elasticity of the material of a given wire by graphically analyzing the variation of tensile force with respect to extension produced by it.

II. Heat

3. Use of Pullinger's apparatus for the Determination of the linear expansion of a rod.

III. Geometrical Optics

4. Use of Travelling Microscope for the determination of the refractive index of glass slab by graphically analyzing how apparent depth varies with the real depth for glass plates of different thicknesses.

IV. Current electricity

10. Verification of Ohm's law and determination of resistance of a thin-film resistor by graphical analysis of variation of electric current in the resistor with respect to potential difference across it.

11. Determination of resistivity of a metal wire by graphical analysis of variation of electric current through a metal wire against its length.

b) Sample project works for grade 11

1. Study the variation in the range of a jet of water with angle of projection
2. Explore the factors affecting the rate of loss of heat of a liquid
3. Study the nature and size of the image formed by a convex lens using a candle and a screen.
4. Comparative study of uses of alternative energy sources in Nepal
5. Study of application of laws and principle of physics in any indigenous technology.
6. Analyze the temperature dependence of refractive index of different liquids using a hollow prism and laser beam.
7. Analyze the frequency dependence of refractive index of glass using a glass prism and white light beam.

c) Some examples of innovative works for grade 11

1. Design and construct a system to demonstrate the phenomenon of total internal reflection (TIR) of a laser beam through a jet of water.
2. Construct a digital Newton meter using the concept of potential divider.

d) Practical Activities for Grade 12

I. Mechanics

1. Use of Simple pendulum for the determination of the value of 'g' in the laboratory by graphically analyzing the variation of period of oscillations with length of the pendulum.
2. Determination of the coefficient of viscosity of liquid by Stoke's method by graphically analyzing the variation of time taken for six metal balls of different diameters to travel the same distance in the given liquid with respect to their diameters.

II. Wave and Optics

4. Determination of the wavelength of He-Ne laser light by passing a plane diffraction grating.
5. Determination of the frequency of A.C. Mains using sonometer and graphically analyzing the variation of the ratio of resonating lengths with respect to the frequency of tuning fork using tuning forks of different frequencies.
6. Determination of velocity of sound in air at NTP using resonance tube.

III. Electricity and magnetism

7. Use of potentiometer for the
   a) Comparison of emf's of two cells
   b) Determination of the internal resistance of a cell
5. Use of deflection magnetometer to determination of the pole strength and magnetic moment of a bar magnet

IV. Modern Physics

c. 11. Study the I-V characteristics of a semiconductor diode.

e) Sampleproject works for grade 12

1. Design and construct a step-up transformer.
2. Construct a simple DC motor using a disk type magnet and a battery.
3. Construct a model of AC generator/dynamo.
4. Construction of a step down transformer attached with a full wave rectifier made from semiconductor diodes.

f) Some examples of innovative works for grade 12

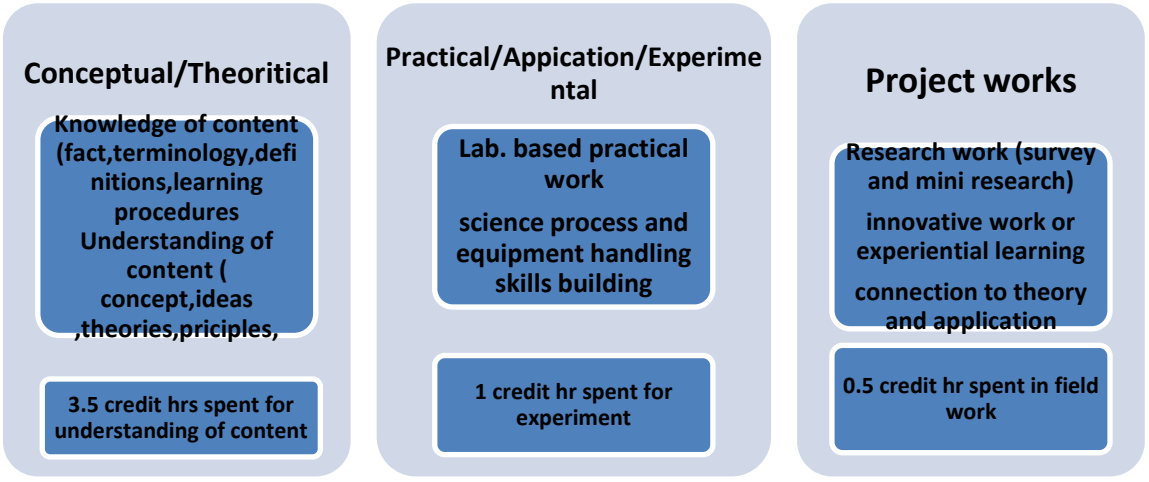
1. Study of the status of hydroelectricity in Nepal.
2. Verify Joule' law.
3. History of space exploration

6. Learning Facilitation Method and Process

Students should be facilitated to learn rather than just accumulation of information. Teacher plays vital role for delivering subject matters although others' role is also important. Student centered teaching-learning process is highly emphasized. Students are supposed to adopt multiple pathway of learning, such as online search, field visit,

library work, laboratory work, individual and group work, research work etc. with the support of teacher. Self-study by students is highly encouraged and learning should not be confined to the scope of curriculum. Teacher should keep in mind intra and inter-disciplinary approach to teaching and learning, as opposed to compartmentalization of knowledge. Supportive role of parents/guardians in creating conducive environment for promoting the spirit of inquiry and creativity in students' learning i anticipated.

During the delivery process of science teaching in grade 11 and 12, basically following three approaches will be adopted;



a) Conceptual/Theoretical Approach

Possible theoretical methods of delivery may include the following;

- interaction
- question answer
- demonstrations
- ICT based instructions
- cooperative learning
- group discussions (satellite learning group, peer group, small and large group)
- debate
- seminar presentation
- Journal publishing
- daily assignment

b) Practical/Application/Experimental approach

Practical work is the integral part of the learning science. The process of lab based practical work comprises as;

- familiarity with objective of practical work
- familiarity with materials, chemicals, apparatus
- familiarity with lab process (safety, working modality etc.)
- conduction of practical work (systematically following the given instruction)
- analysis, interpretation and drawing conclusion

c) Project work Approach

Project work is an integral part of the science learning. Students should be involved in project work to foster self-learning of students in the both theoretical and practical contents. Students will complete project work to have practical idea through learning by doing approach and able to connect the theory into the real world context. It is regarded as method/ process of learning rather than content itself. So use of project work method to facilitate any appropriate contents of this curriculum is highly encouraged.

In this approach student will conduct at least one **research work, or an innovative work** under the guidance of teacher, using the knowledge and skills learnt. It could include any of the followings;

(f) Mini research
(g) Survey
(h) Model construction
(i) Paper based work
(j) study of ethno-science

General process of research work embraces the following steps;

- Understanding the objective of the research
- Planning and designing
- Collecting information
- analysis and interpretation
- Reporting /communicating (presentation, via visual aids, written report, graphical etc.)

General process of innovative work embraces the following steps;

- identification of innovative task (either assigned by teacher or proposed by student)
- planning
- performing the task
- presentation of the work
- Record keeping of the work

Students are free to choose any topic listed in this curriculum or a topic suggested by teacher provided that it is within the theoretical contents of the Curriculum. However, repetition of topic should be discouraged.

Learning process matrix

Knowledge and understanding	Scientific skills and process	Values, attitudes and application to daily life
• Scientific phenomenon, facts, definition, principles, theory, concepts and new discoveries • Scientific vocabulary, glossary and terminology • Scientific tools, devises, instruments apparatus • Techniques of uses of scientific instruments with safety • Scientific and technological applications	• Basic and integrated scientific process skills <u>Process</u> • Investigation • Creative thinking • problem solving	• Responsible • Spending time for investigation

Basic Science Process Skills includes,

7. Observing: using senses to gather information about an object or event. It is description of what was actually perceived.
8. Measuring:comparing unknown physical quantity with known quantity (standard unit) of same type.

9. Inferring:formulating assumptions or possible explanations based upon observations.
10. Classifying:grouping or ordering objects or events into categories based upon characteristics or defined criteria.
11. Predicting:guessing the most likely outcome of a future event based upon a pattern of evidence.
12. Communicating:using words, symbols, or graphics to describe an object, action or event.

Integrated Science Process Skills includes,

11. Formulating hypotheses:determination of the proposed solutions or expected outcomes for experiments. These proposed solutions to a problem must be testable.
12. Identifying of variables: Identification of the changeable factors (independent and dependent variables) that can affect an experiment.
13. Defining variables operationally: explaining how to measure a variable in an experiment.
14. Describing relationships between variables**:** explaining relationships between variables in an experiment such as between the independent and dependent variables.
15. Designing investigations:designing an experiment by identifying materials and describing appropriate steps in a procedure to test a hypothesis.
16. Experimenting:carrying out an experiment by carefully following directions of the procedure so the results can be verified by repeating the procedure several times.
17. Acquiring data:collecting qualitative and quantitative data as observations and measurements.
18. Organizing data in tables and graphs:presenting collected data in tables and graphs.
19. Analyzing investigations and their data: interpreting data, identifying errors, evaluating the hypothesis, formulating conclusions, and recommending further testing where necessary.

20. Understanding cause and effect relationships: understanding what caused what to happen and why.
21. Formulating models: recognizing patterns in data and making comparisons to familiar objects or ideas.

7. Student Assessment

Evaluation is an integral part of learning process. Both formative and summative modes of evaluation are emphasized. Formative evaluation will be conducted so as to provide regular feedback for students, teachers and parents/guardians about how student learning is. Class tests, unit tests, oral question-answer, home assignment etc.are some ways of formative evaluation.

There will be separate evaluation of theoretical and practical learning. Summative evaluation embraces theoretical examination, practical examination and evaluation of research work or innovative work.

(a) Internal Evaluation

Out of 100 full marks Internal evaluation covers 25 marks. Internal evaluation consists of Practical work (16 marks), (b) Marks from trimesterexaminations(6 marks), and (c) Classroom participation (3 marks)

- **Practical Activities**

Practical work and project work should be based on list of activities mentioned in this curriculum or designed by the teacher. Mark distribution for practical work and project work will be as follows:

S. N.	Criteria	Elaboration of criteria	Marks
1.	Laboratory experiment	Correctness of apparatus setup/preparation	2
		Observation/Experimentation	2
		Tabulation	1
		Data processing and Analysis	1
		Conclusion (Value of constants or prediction with justification)	1
		Handling of errors/precaution	1
2.	Viva-voce	Understanding of objective of the experiment	1

		Skills of the handling of apparatus in use	1
		Overall impression	1
3.	Practical work records and attendance	Records (number and quality)	2
4	Project work	Reports (background, objective, methodology, finding, conclusion	2
		Presentation	1
		Total	**16**

Note: (i) Practical examination will be conducted in the presence of internal and external supervisors. Evaluation of laboratory experiment will focus both the product of work and skills competencies of student in using apparatus.

(ii) Project work assessment is the internal assessment of reports and presentation of their project works either individually or group basis. In case of group presentation, every member of the group should submit a short reflection on the presented report in their own language. Records of project works must be attested by external supervisor.

- **Marks from trimester examinations**

Total of 6 marks; 3 marks from each trimester.

- **Classroom participation (3 marks)**

Classroom participation includes attendance (1) and participation in learning (2).

(b) External Evaluation

Out of 100 marks theoretical evaluation covers 75 marks. The tool for external evaluation of theoretical learning will be a written examination. Questions for the external examination will be based on the specification grid developed by Curriculum Development Centre. Examination question paper will be developed using various levels of revised Bloom's taxonomy including remembering level, understanding level, application level and higher ability (analyzing, evaluating, creating).

Specification Grid

Grade : 11 **Subject : Physics** Time: 3 hrs.

S.N.	Area	Working hour	Competency level				Area wise Score
			Knowledge/ Remembering	Understanding	Applying	Higher Ability	
1	Mechanics	27	MCQ (2x1) SQ (2x5)	MCQ (5 x1) SQ (1x5) LQ (1x8)	MCQ (3x1) SQ (2x5) LQ (1x8)	MCQ (1x1) SQ (3x5) LQ (1x8)	28
2	Heat and Thermodynamics	11					11
3	Wave and Optics	12					13
4	Electricity and Magnetism	18					19
5	Modern Physics	4					4
Total		**72**	**12**	**18**	**21**	**24**	**75**

Item format plan

	Type of item	Score per item	Number of items				Total item	Total Score
1	Multiple Choice Questions	1	2	5	3	1	11	11
2	Short Question Answer	5	2	1	2	3	8	40
3	Long Question Answer	8	0	1	1	1	3	24
Grand Total			**4**	**7**	**6**	**5**	**22**	**75**

Grade : 12

S.N.	Area	Working hour	Competency level				Area wise Score
			Knowledge/ Remembering	Understanding	Applying	Higher Ability	
1	Mechanics	18	MCQ (2x1)	MCQ (5 x1)	MCQ (3x1)	MCQ (1x1)	19
2	Heat and Thermodynamics	2					2

3	Wave and Optics	15	SQ (2x5)	SQ (1x5)	SQ (2x5)	SQ (3x5)	16
4	Electricity and Magnetism	20		LQ (1x8)	LQ (1x8)	LQ (1x8)	21
5	Modern Physics	17					17
Total		**72**	**12**	**18**	**21**	**24**	**75**

Item format plan

	Type of item	Score per item	Number of items				Total item	Total Score
1	Multiple Choice Questions	1	2	5	3	1	11	11
2	Short Question Answer	5	2	1	2	3	8	40
3	Long Question Answer	8	0	1	1	1	3	24
Grand Total			**4**	**7**	**6**	**5**	**22**	**75**

Remarks:

- Item format in composite should be met as per the specification grid.
- ±1 marks variation will be allowed within the area. But cannot be nil.
- In case of 5 or 8 marks items, these should ensure that 1 mark will be assigned per element expected as correct response. However, cognitive behavior intended might not be single behavior within the item. But in total cognitive distribution should met. ±2 marks variation will be allowed within the cognitive levels.
- SQ and LQ can be structured (have two or more sub-items). SQ and LQ can be distributed to two or more cognitive behaviors. In such case these will be added to their respective cognitive behavior. In sum the distribution of cognitive behavior should be approximately to the required distribution.
- The distribution of questions based on cognitive domain will be nearby 15% knowledge/remembering, 25% understanding, 30% applying and 30% higher ability level.
- In case of short question there will be 2 "OR" questions and in case of long question there will be 1 "OR" question.

Electrical Measurements and Instruments

Grades: 11 **Credit hrs: 4** **Working hrs: 128**

1. Introduction

Electrical measurements are the methods, devices and calculations used to measure electrical quantities. Measurement of electrical quantities may be done to measure electrical parameters of a system and different instruments are used for this. This curriculum is developed to provide students with the fundamental knowledge and skills related to electrical measurements and instruments.

This curriculum comprises of the contents like electrical measuring instrument, resistance measurement, Inductance and capacitance measurement, shunts and multipliers, potentiometers, power, energy and frequency meter and non-electrical quantities measurement by electrically measuring instruments. These contents are expected to empower the students with the basic and fundamental knowledge and skills related to the contents on the course.

The curriculum has been offered as per the structure of National Curriculum Framework 2076. It provides a comprehensive outline of level-wise competencies, grade-wise leaning outcomes and scope and sequence of contents, suggested practical/project activities, learning facilitation process and assessment strategies so as to enhance the learning on the subject systematic.

2. Competencies

The students shall have developed the following competencies:

1. Compare the construction, operation and connection of electrical circuit instruments measuring electrical as well as non-electrical quantities
2. Differentiate various electrical measuring instruments
3. Connecting circuits and measure above-mentioned quantities using digital and analog measuring instruments

3. Grade-wise Learning Outcomes

S.N.	Content Area	Learning Outcomes
1	Electrical Measuring instrument	1.1. Introduce measuring instruments. 1.2. Identify the types of measuring instruments. 1.3. Understand the essential features of indicating instruments, their constructional details, errors, and torques. 1.4. Explain the Principle of operating electrical instruments. 1.5 Introduce Permanent Magnet Moving Coil (PMMC) and Electrodynamics instruments. 1.6. Introduce of Moving iron instruments. 1.7. Understand the applications of Cathode Ray Oscilloscope.
2	Resistance measurement	2.1. Define and classify resistance. 2.2. Measure low resistance and medium resistance. 2.3. Measure high resistance and continuity by using megger. 2.4. Introduce Earth resistance meter.
3	Inductance and capacitance measurement	3.1 Introduce Inductor. 3.2 Understand the concept of Inductance and its characteristics. 3.3 Introduce capacitor. 3.4 Understand the concept of capacitance and its characteristics. 3.5 Measure Inductance and Capacitance.
4	Shunts and multipliers	4.1 Introduce Shunt and multipliers. 4.2 Calculate the value of shunt and multiplier to extend the range of ammeter and voltmeter. 4.3. Applications of shunt and multipliers.
5	Potentiometers	5.1. Introduce potentiometer. 5.2 Understand the Principle of operation of potentiometer. 5.3. Measure the unknown emf using potentiometer
6	Instrument	6.1 Introduce instrument transformers with its applications.

	Transformers	6.2 Understand the connection diagram of CT and PT.
7	Power, energy and frequency meter	7.1. Introduce wattmeter, energy meter and frequency meter. 7.2. Measure power, frequency, power factor and energy in single phase circuit. 7.3. Understand the methods of three phase power measurement.
8	Non electrical quantities measurement by electrically measuring instruments	7.1. Introduce Thermocouple. 7.2 Introduce Transducers and their functions. 7.3 Identify different types of Transducers. 7.4. Introduce Piezometer and its applications. 7.5. Introduce Illumination-meter. 7.6 Measure light energy using lux-meter.

4. Scope and Sequence of Contents

S.N.	Content Area	Elaboration of Contents	Hrs.
1	Electrical Measuring instrument	1.1. Types of measuring instruments 1.1.1 Introduction to measuring instruments. 1.1.2 Analog and Digital Instruments 1.1.3 Types of measuring instruments As per comparison with the standard • Absolute Instrument • Secondary Instrument As per signal processing o Analog Instrument • Digital Instrument	**16**

		1.1.4. Types of Secondary Instruments • Indicating Instrument • Recording Instrument • Integrating Instrument 1.2. Essential features of indicating instruments, their constructional details, errors 1.2.1 Features of indicating Instruments 1.2.2 Constructional details of indicating Instruments 1.2.3 Types of errors 1.3. Explain the Principle of operating electrical instruments 1.3.1. Classification of instruments on the basis of principle of operation 1. Moving Coil Instruments a. Permanent Magnet Moving Coil (PMMC) instruments b. Electrodynamics instruments – principle of operation, constructional details 2. Moving Iron Instruments a. Attraction Type Instruments b. Repulsion type Instruments 1.4. Permanent Magnet Moving Coil (PMMC) instruments –principle of operation, constructional details, scale features. 1.4.1 Introduction, working principle and construction detail of PMMC instruments. 1.4.2 Advantages and disadvantages of PMMC	

		instruments 1.5. Electrodynamics instruments – principle of operation, constructional details 1.5.1 Introduction, working principle and construction detail of electrodynamics instrument 1.5.2. Advantages and disadvantages of electrodynamics instrument. 1.6. Moving iron instruments (Attraction type and repulsion type) : Principle of operation, constructional details, scale features 1.6.1 Introduction, working principle and construction detail of moving iron instrument. 1.6.2. Advantages and disadvantages of moving iron instrument 1.7. Cathode Ray Oscilloscope, introduction and its applications. 1.7.1. General introduction of Cathode Ray Oscilloscope 1.7.2 Explain the applications of Cathode Ray Oscilloscope.	
2	**Resistance measurement**	2.1. Classification of resistance. 2.1.1 General introduction of resistance. 2.1.2 Classification of resistance 2.2. Ammeter and voltmeter method for the measurement of low resistance. 2.2.1 Connecting procedure of Ammeter and Voltmeter low resistance. 2.3. Measurement of medium resistance 2.3.1 Wheatstone bridge method of resistance measurement 2.4. Megger construction and principle of operation	**8**

		for measurement of high resistance 2.5. Earth resistance meter, its construction, principle of operation, application 2.6.1 Introduction and working principle of earth resistance tester 2.6.2 Application of earth resistance tester	
3	**Inductance and capacitance measurement**	3.1 Inductor definition 3.2 Factors affecting inductance 3.3 Capacitor definition 3.4 Factors affecting capacitance 3.5 Measurement of the value of Inductance and Capacitance.	**4**
4	**Shunts and multipliers**	4.1 Introduction of Shunt and multipliers 4.1.1 Characteristics and use of Shunts and multipliers. 4.2. Types of Multi range Meters – • Ammeters, • Voltmeters • Ohm meter. 4.2.2. Explain the applications of Multi range Meters.	**6**
5	**Potentiometers**	5.1. Introduction of potentiometer. 5.2. General principle of operation of potentiometer. 5.3. Measurement of unknown emf and resistance using potentiometer.	**6**
6	**Instrument Transformer**	6.1 Introduction of instrument transformers 6.2 Construction, working principle and functions of CT 6.3 Measurement of high current using CT 6.4 Construction, working principle and functions of PT 6.5 Measurement of high voltage using PT	**8**
7	**Power, energy**	7.1 Explain the connection diagram of single phase	**8**

	and frequency meter	wattmeter. 7.2. Method of power measurement in 3 phases circuits: i) Two watt meters method ii) Three watt meters method 7.3. Introduction of Var-meter, connection into electrical circuit, application of measurement of reactivepower 7.4. Single phase kwh-meter-construction, principle of operation, connection into electrical circuit 7.5. Frequency-meter-construction, operation and application. 7.5.1. Introduction of frequency meter (Vibrating Reed) 7.5.2 Connection diagram of frequency meter.	
8	**Non electrical quantities measurement by electrically measuring instruments**	8.1. Thermocouple-construction, principle of operation, application. 8.1.1. Introduction and construction of thermo couple 8.1.2 Working principle of thermo couple 8.1.3 Applications of thermo couple 8.2 Transducers 8.2.1. Introduction of transducers. 8.2.2. Types of transducers 8.2.3 Components of transducers 8.2.4 Applications of transducers 8.3 Piezometer, its introduction and applications 8.4. Illumination-meter 8.4.1. Definition of Illumination. 8.4.2. Introduction of lux-meter and its applications	**8**
	Total		**64**

5. Suggested Practical and Project Works

Practical and project work is an integral part of technical and vocational subjects. They are carried out to consolidate the practical learning experiences. Some of the suggested practical and project work activities of this subject are mentioned below. As these are the basic and fundamental practical and project works, the teacher can adapt or introduce more relevant to their context and students' needs.

S.N.	Grade 11		
	Scope	**Practical Activities**	**Hrs.**
1	Electrical Measuring instrument	i. Connect the electrical measuring instruments like voltmeter, ammeter (analog and digital) to measure required electrical quantities both ac and dc. ii. Use a digital multi-meter to measure A.C and D.C electrical quantity and resistance. Compare the results with analogue multi-meter. iii. Measure voltage and frequency of a sinusoidal ac using CRO and observe various waveforms.	**15**
2	Resistance measurement	Measure low, medium and high resistance by ammeter voltmeter method, wheatstone bridge method and using megger.	**10**
3	Inductance and capacitance measurement	Measure inductance and capacitance.	**5**
4	Shunts and multipliers	Calculate the values of shunt and multiplier to extend the range of ammeter and voltmeter.	**5**
5	Potentiometers	Measure resistance using a bridge, potentiometer and ammeter/voltmeter methods. Compare results.	**5**
6	Instrument Transformers	Measure high current and high voltage using CT and PT.	**5**

7	Power, energy and frequency meter	i. Measure power and power factor in a single phase circuit using wattmeter, voltmeter and ammeter. ii.Measure frequency using frequency meter. iii.Measure energy at different loads using single phase energy meter.	**10**
8	Non electrical quantities measurement by electrically measuring instruments	i.Measure illumination in various places at your laboratory using illumination-meter, compare results with national and international standards. ii. Measure temperature using thermocouple.	**9**
	Total		**64**

6. Learning Facilitation Process

This course aims to blend both theoretical and practical aspects of knowledge and skills required in the subject. So, its facilitation process differs from the traditional method of delivery. The practical aspect is much more focused. So, methods and strategies that enable the practical skills in the students are much used in course of content facilitation. A facilitator encourages and assists students to learn for themselves engaging in different activities with practical tasks. To achieve the entire objectives from this syllabus, the teacher must use different techniques and process while teaching. In particular, the teacher can make use of the following methods and strategies for the learning facilitation:

- Discussion
- Demonstration
- Problem solving
- Presentation
- Case study
- Practical works
- Project works
- Field study

- Group works and pair works
- Exploration

7. Student Evaluation

Evaluation is an integral part of learning process. Both formative and summative modes of evaluation are emphasized. Formative evaluation will be conducted so as to provide regular feedback for students, teachers and parents/guardians about how student learning is. Class tests, unit tests, oral question-answer, home assignment etc, are some ways of formative evaluation.

There will be separate evaluation of theoretical and practical learning. Summative evaluation embraces theoretical examination, practical examination and evaluation of research work or innovative work.

(a) Internal Evaluation

Internal evaluation covers 50 Percent weight age. Internal evaluation consists of Practical Activities (Practical works and projects works) (35 Percent), (b) Marks from trimester examinations (10 Percent), and (c) Classroom participation (5 Percent). Practical work should be based on list of activities mentioned in this curriculum. Project works should be based on the mentioned lists or created by teachers. Mark distribution for internal evaluation (practical work and project work) will be as follows:

S.N.	Mani activities	Activities in detail	Percent
1	Participation	Participation in attendance, homework, classwork, project work, practical works etc.	5
2	Practical work	Conduction of practical work activities	15
		Record keeping of practical work activities	3
3	Project work	Conduction of project work activities	10
		Record keeping of project work activities	2
4	Viva	Viva of practical work and project work activities	5
6	Internal exam	First trimester 5 marks and Second trimester 5 marks	10
Total			50

Note:

(i) Practical examination will be conducted in the presence of internal and external supervisors. Evaluation of experiment will focus both the product of work and skills competencies of student in using apparatus.

(ii) Project work assessment is the internal assessment of reports and presentation of their project works either individually or group basis. In case of group presentation, every member of the group should submit a short reflection on the presented report in their own language. Records of project works must be attested by external supervisor.

(b) External Evaluation

Theoretical evaluation covers 50% of the weight. The tool for external evaluation of theoretical learning will be a written examination. Questions for the external examination will be based on the specification grid developed by Curriculum Development Centre. Examination question paper will be developed using various levels of revised Bloom's taxonomy including remembering level, understanding level, application level and higher ability (analyzing, evaluating, creating).

Specification Grid

Grade: 11 Subject: Electrical Measurements and Instruments Time: 2 hrs.

Unit	Content	Credit hrs.	Knowledge and Understand			Application			Higher Ability			Total Question Number			Total Question	Marks Weight			Total Marks
			MCQ	Short	Long	MCQ	Short	Long	MCQ	Short	Long	MCQ	Short	Long		MCQ	Short	Long	
1	Electrical Measuring instrument	16																	11
2	Resistance measurement	8																	6
3	Inductance and capacitance measurement	4	4	3	1	4	2	0	1	0	1	9	5	2	16	9	25	16	2
4	Shunts and multipliers	6																	5
5	Potentiometers	6																	5
6	Instrument Transformer	8																	5
7	Power, energy and frequency meter	8																	9

8	Non electrical quantities measurement by electrically measuring instruments	8																	7
	Total	64	4	3	1	4	2	0	1	0	1	9	5	2	16	9	25	16	50

Electrical Installation, Estimation and Circuit Design

Grades: 11 **Credit hrs: 4** **Working hrs: 128**

1. Introduction

An electrical installation is an implementation of design into practice. Before carrying out the installation works, design and estimation are to be carried out. This course is developed to equip the students with the knowledge and skills needed for the real world of work.

This curriculum comprises of the contents like general principles of estimation, design of illumination scheme for residential and commercial buildings, design consideration of electrical installation in buildings, introduction to electrical supply system for industrial buildings, system components for industrial illumination, illuminating design principle, out-door lighting system design, electrification of industrial building, Earthing system for commercial and industrial building, cables and terminations, distribution substation of industrial plan and emergency and back-up supply system for industrial plant.

The curriculum prepared in accordance with National Curriculum Framework is structured in such a way that it incorporates the level-wise competencies, grade-wise leaning outcomes, scope and sequence of contents, suggested practical/project activities, learning facilitation process and assessment strategies to enhance the learning on the subject systematically.

2. Competencies

On completion of the course, the students will have the following competencies:

1. Estimate the required quantity and cost of materials
2. Establish lighting installation for specific applications
3. Design lighting and power sub circuits for specific applications
4. Design distribution board (DB)

5. Perform proper sizing of distribution board
6. Maintain the cable construction; apply its laying methods and inspection methods for fault detection
7. Understand the details of electric installation practices used in commercial and industrial buildings.

3. Grade-wise Learning Outcomes

S.N.	Content Area	Learning Outcomes
1	General Principles Estimation	1.1 Introduce Estimating. 1.2 Provide concept of catalogues. 1.3 Explain the need of recording of estimate. 1.4 Determine required quantity of material. 1.5 Determine of cost of material and labor. 1.6 Introduce contingencies and overhead charges.
2	Illumination Engineering	2.1 Introduce illumination. 2.2 Describe the terms in illumination. 2.3 Describe laws of illumination. 2.4 List the types of light sources. 2.5 Introduce principle of lighting control, specular reflection and diffuse reflection. 2.6 List out the types of lighting schemes. 2.7 Design of lighting schemes. 2.8 List types of industrial lighting systems 2.9 List out the methods of lighting calculation. 2.10 Design procedure of lighting.
3	Electrical Installation in Commercial Buildings	3.1 Introduce electric supply system. 3.2 Describe the protection of electrical installation against overload, short circuit and earth fault. 3.3 List out the requirement of electrical installation.

		3.4 Provide the electricity rules. 3.5 Design of MDB and SDB. 3.6 Design of lighting and power sub circuits. 3.7 List the guidelines for installation of fittings.
4	Out-door Lighting System Design	4.1 Introduce outdoor lighting. 4.2 Select the street light sources. 4.3 Select luminaries. 4.4 Design the procedure of street lighting scheme. 4.5 Introduce the basic floodlighting effects. 4.6 Select floodlight sources. 4.7 Design the procedures of out-door lighting.
5	Electrification of Industrial Buildings	1.1 Introduce wiring system. 1.2 Select the types of wiring and rating of wires & cables. 1.3 Introducethe protective switchgears. 1.4 Identify energy and power requirement for Lift, conveyor-belt and HVAC. 1.5 Introduce the load estimation. 1.6 List out the procedures to design circuits. 1.7 Select the rating of main Panel Board and distribution board.
6	Cables and Terminations	6.1 Introduce cables and its construction. 6.2 List out the types of cables. 6.3 Install cables and find any fault in cable. 6.4 Introduce the connectors and terminators.
7	Distribution Substation of Industrial Plan	7.1 Introduce the substation. 7.2 Classify the substation. 7.3 Select and locate site. 7.4 Show schematic diagram of distribution substation. 7.5 Identify equipment and measuring accessories for substations and switch gear installation.

8	Earthing System for Commercial and Industrial Building	8.1 Introduce anearthing system. 8.2 Find the points to be Earthed. 8.3 List out the factors influencing the earth resistance. 8.4 List out the methods of reducing earth resistance. 8.5 List out methods of Earthing.
9	Emergency and Back-up Supply System for Industrial Plant	9.1 Introduce a battery supply system. 9.2 Introduce Emergency Supply System. 9.3 Introduce Uninterrupted Supply for Critical Load.

4. Scope and Sequence of Contents

S.N.	Content Area	Elaboration of Contents	Hrs.
1	General Principles of Estimation	1.1 Estimating: estimate of quantities and cost analysis 1.2 Familiarization of catalogues 1.3 Recording of estimate 1.4 Determination of required quantity of material • Preparation of BOQ for transformer installation(e.g. 25 KVA transformer) • Preparation of BOQ for Distribution line(e.g. 300 m distribution line) • Preparation of BOQ for electrification of commercial Buildings 1.5 Determination of cost of material and labor 1.6 Contingencies and overhead charges	5
2	Illumination Engineering	2.1 Introduction 2.2 Terminology in illumination 2.3 Laws of illumination 2.4 Various types of light sources ✓ Incandescent Filament Lamps	20

		✓ Fluorescent Lamps ✓ High Intensity Discharge Lamps ✓ LED Lamps ✓ Types Luminaries 2.5 Basic principle of lighting control, • Specular Reflection • Diffuse Reflection 2.6 Types of lighting schemes • Direct lighting • Semi direct lighting • Semi indirect lighting • Indirect lighting **2.3** Purposes for Designing of lighting schemes **2.4** Types of industrial lighting systems • Factory lighting • Emergency lighting • Security lighting **2.5** Methods of lighting calculation • Watts per square meter method • Lumen or light flux method • Point to point or inverse square law method **2.6** Design procedure	
3	Electrical Installation in commercial Buildings	3.1 Electric supply system: single phase two wire and three phase four wire systems 3.2 Protection of electrical installation against overload, short circuit and earth fault 3.3 General requirement of electrical installation 3.4 Electricity rules • Testing of installation • Neutral and earth wire	5

		• Service connections • Sub-circuits • Location of outlets, control switches, MDB and SDB 3.5 Design and calculation of the size of MDB and SDB 3.6 Design and calculation of number of lighting and power sub circuits(i.e considering maximum load and number of points that can be connected to lighting and power sub circuits) 3.7 Guidelines for installation of fittings	
4	Out-door Lighting System Design	4.1 Introduction 4.2 Selection of Street Light Sources 4.3 Selection of Luminaries 4.4 Design Procedure of Street Lighting Scheme 4.5 Basic Floodlighting Effects 4.6 Selection of Floodlight Sources 4.7 Design Procedures 4.8 Application Guide: Buildings and color considerations, Examples of flood lighting installation.	8
5	Electrification of Industrial Buildings	5.1 Wiring system 5.2 Selection of type of wiring and rating of wires & cables 5.3 Protective switchgears- HRC Fuse, MCB, MCCB, RCCBs and accessories 5.4 Energy and power requirement for Lift, conveyor-belt and HVAC 5.5 Load Estimation (Sizing of transformers , cables) 5.6 Procedures to design circuits and deciding the	8

		number of circuits 5.7 Selection of rating of main Panel Board and distribution board 5.8 Introductions to motor control Centers (MCCs) 5.9 Methods to draw single line diagram and design procedure	
6	Cables and Terminations	6.1 Cables 6.1.1 Cable construction 6.1.2 Types of cables 6.1.3 Cable Ratings: voltage rating & conductor size 6.1.4 Installation of cable 6.1.5 Locating cable faults • Murray Loop test for earth fault and short circuit fault • Test for open circuit faults 6.2 Connectors and terminations 6.1.1 Types of connectors and applications 6.1.2 Types of terminations and methods 6.1.3 Splicing devices and techniques	5
7	Distribution Substation of Industrial Plan	7.1 Introduction 7.2 Classification 7.3 Indoor substations 7.4 Out-door substations 7.5 Selection and location of site 7.6 Schematic diagram of distribution substation 7.7 Equipment and measuring accessories for substations and switch gear installation	5
8	Earthing System for Commercial and Industrial Building	8.1 Introduction 8.2 System & Equipment Earthing 8.3 Point to be Earthed 8.4 Factors Influencing the earth resistance	4

		8.5 Method of reducing earth resistance 8.6 Methods of Earthing 8.7 Earthing for Lightning Protection	
9	Emergency and Back-up Supply System for Industrial Plant	9.1 Battery Supply System • Battery Installation • Charging and Maintenance 9.2 Emergency Supply System 9.3 Uninterrupted Supply for Critical Load 9.4 Introduction to AMF and ATSpannels	4
	Total		**64**

5. Suggested Practical and Project Works

The practical work that students do during their course is aimed at providing them learning opportunities to accomplish competency of the curriculum as well as reinforcing their learning of the theoretical subject content. Similarly, involving in a project work fosters the self-learning of students in the both theoretical and practical contents. As this subject emphasizes to develop both theoretical and practical knowledge and skills, some of the practical and project works are suggested for the students. However, the tasks presented here are the samples only. A teacher can assign the extra practical and project works as per the students' need or specific context.

S.N.	**Grade 11**		
	Content Area	**Suggested Practical Activities**	**Hrs.**
1	General Principles of Estimation	1.1 Basic introduction to electrical symbols and standards 1.2 Conducting market study and collecting informative brochures and specification on various product available about electrical lamp, appliances and equipment's	**6**

		1.3 Preparation of BOQ for electrical installation (transformer, line etc)	
2	Illumination Engineering	2.1 Observe the different types of sources of light. 2.2 Compare illumination level of different sources of light using lux-meter. 2.3 Prepare a report on calculation of number of lamps required for different purpose rooms and draw a layout of arrangement of light fixture.	**10**
3	Electrical Installation in commercial Buildings	3.1 Observe different kind of wiring accessories (Switches, sockets, conductors, distribution board etc) and protective devices (fuse, MCB and MCCB) of different variants. 3.2 Design lighting and power sub-circuits in different kinds of buildings. 3.3 Design a distribution board with proper sizing of protective devices.	**18**
4	Outdoor lighting System Design	4.1 Observe different kinds of outdoor light fixtures. 4.2 Design a street light scheme. 4.3 Design a flood light scheme for stadium, cinema hall etc.	**10**
5	Electrification of Industrial Buildings	5.1 Field visit to a nearby industryfor industrial wiring system. 5.2 Observe the protective gears of industrial buildings. 5.3 Calculate the size of MCCB for different sizes of motor. 5.4 Calculate the size of cables required for different sizes of motors.	**4**
6	Cables and Terminations	6.1 Observe the different types of cables and their constructional parts. 6.2 Study of 11kV cable termination and joints.	**4**

		6.3 Study of test of cables. 6.4 Perform insulation test of 11kV cable using insulation resistance tester.	
7	Distribution Substation of Industrial Plan	7.1 Visit to a nearby distribution substation of an industrial building. 7.2 Draw a single line diagram and layout of distribution system. **7.3** Prepare a report on forundation mounted substation.	**4**
8	Earthing System for Commercial and Industrial Building	8.1 Measurement of earth resistance of existing earthing system. 8.2 Demonstration of rod, pipe and plate earthing. 8.3 A field visit to a nearby commercial or industrial building to observe the earthing arrangement.	**4**
9	Emergency and Back-up Supply System for Industrial Plant	9.1 Visit to a nearby commercial or industrial building to study the backup system provision. 9.2 Understand the function of UPS, ATS panel, DG etc.	4
	Total		**64**

6. Learning Facilitation Process

Learning facilitation process is determined according to the content to be dealt in the subject. It's also an art of teacher. The teacher should utilize such teaching methods and techniques that are appropriate to the contents and needs of the students. In facilitating the course, various approaches, methods and techniques are used. To be particular, the following major methods and strategies are used in this subject:

- Discussion
- Problem solving
- Demonstration
- Presentation

- Case study
- Practical works
- Project works
- Field study
- Group works and pair works
- Questionnaire
- Exploration

7. Student Evaluation

Evaluation is an integral part of learning process. Both formative and summative modes of evaluation are emphasized. Formative evaluation will be conducted so as to provide regular feedback for students, teachers and parents/guardians about how student learning is. Class tests, unit tests, oral question-answer, home assignment etc, are some ways of formative evaluation.

There will be separate evaluation of theoretical and practical learning. Summative evaluation embraces theoretical examination, practical examination and evaluation of research work or innovative work.

(a) Internal Evaluation

Internal evaluation covers 50 Percent weight age. Internal evaluation consists of Practical Activities (Practical works and projects works) (35 Percent), (b) Marks from trimester examinations (10 Percent), and (c) Classroom participation (5 Percent). Practical work should be based on list of activities mentioned in this curriculum. Project works should be based on the mentioned lists or created by teachers. Mark distribution for internal evaluation (practical work and project work) will be as follows:

S.N.	Mani activities	Activities in detail	Percent
1	Participation	Participation in attendance, homework, classwork, project work, practical works etc.	5
2	Practical work	Conduction of practical work activities	15
		Record keeping of practical work activities	3
3	Project work	Conduction of project work activities	10

		Record keeping of project work activities	2
4	Viva	Viva of practical work and project work activities	5
6	Internal exam	First trimester 5 marks and Second trimester 5 marks	10
Total			50

Note:

(i) Practical examination will be conducted in the presence of internal and external supervisors. Evaluation of experiment will focus both the product of work and skills competencies of student in using apparatus.

(ii) Project work assessment is the internal assessment of reports and presentation of their project works either individually or group basis. In case of group presentation, every member of the group should submit a short reflection on the presented report in their own language. Records of project works must be attested by external supervisor.

(b) External Evaluation

Theoretical evaluation covers 50% marks. The tool for external evaluation of theoretical learning will be a written examination. Questions for the external examination will be based on the specification grid developed by Curriculum Development Centre. Examination question paper will be developed using various levels of revised Bloom's taxonomy including remembering level, understanding level, application level and higher ability (analyzing, evaluating, creating).

Specification Grid

Grade: 11 Subject: Electrical Installation, Estimation and Circuit Design Time: 2 hrs.

Unit	Content	Credit hrs.	Knowledge and Understand			Application			Higher Ability			Total Question Number			Total Question	Marks Weight			Total Marks
			MCQ	Short	Long	MCQ	Short	Long	MCQ	Short	Long	MCQ	Short	Long		MCQ	Short	Long	
1	General Principles of Estimation	5																	5
2	Illumination Engineering	20																	15
3	Electrical Installation in commercial Buildings	5																	2
4	Out-door Lighting System Design	8																	8
5	Electrification of Industrial Buildings	8																	6
6	Cables and Terminations	5																	5
7	Distribution Substation of Industrial Plan	5	4	3		5	1	1	0	1	1	9	5	2	16	9	25	16	5

8	Earthing System for Commercial and Industrial Building	4																	2
9	Emergency and Back-up Supply System for Industrial Plant	4																	2
	Total	64	4	3		5	1	1	0	1	1	9	5	2	16	9	25	16	50

Electrical Power System

Grades: 11 **Credit hrs: 4** **Working hrs: 128**

1. Introduction

An electric power system is a network of electrical components deployed to supply, transfer, and use electric power. *Electrical Power Systems* provides comprehensive, foundational content for a wide range of topics in power system operation and control. With the growing importance of grid integration of renewables and the interest in smart grid technologies it is more important than ever to understand the fundamentals that underpin electrical power systems. This curriculum is designed to help students acquire the basic skills and understanding on such electrical system.

This curriculum comprises of the contents related to introduction to electric power system, supply system, power plants, sub-stations, power system operation and power factor improvement. The course itself is of practical nature, thereby, the pedagogical approaches in delivering the course should consider the balance between theory and practice. The course will impart the student not only the basic knowledge and skills in the various aspects of electrical power system but also help them use in the world of work.

The curriculum prepared in accordance with National Curriculum Framework is structured in such a way that it incorporates the level-wise competencies, grade-wise leaning outcomes, scope and sequence of contents, suggested practical/project activities, learning facilitation process and assessment strategies so as to enhance the learning on the subject systematically.

2. Competencies

The students will have the following competencies:

1. Explain the concept of electrical power system
2. Describe the different terminologies as used in Economics of generation.
3. Distinguish the types of power plants.
4. Understand the power system operation and use its basic skills
5. Understand the concept of power factor and use the ways of improvement.

3. Grade-wise Learning Outcomes

S.N.	Content Area	Learning Outcomes
1	Introduction to power system	1.1 Introduce power system. 1.2 List out power system components.
2	Economics of Generation	2.1 Describe power system structure. 2.2 Introduce electrical supply system. 2.3 Compare DC and AC system. 2.4 Compare between the overhead and underground system.
3	Power Plants	3.1 Introduce the power plant. 3.2 List the types of power plants. 3.3 Introduce a diesel power plant. 3.4 Introduce a hydro power plant. 3.5 Introduce thermal power plant.
4	Power system operation	4.1 Identify the normal and abnormal condition in power system. 4.2 Show the relationship between voltage and reactive power. 4.3 Show the relation between frequency and active power.
5	Power factor improvement	5.1Introduce power factor. 5.2 List out the dis-advantages of low power factor. 5.3 Explain the causes of low power factor. 5.4 List out the methods of power factor improvement. 5.5 List out the advantages of power factor improvement.

4. Scope and Sequence of Contents

S.N.	Content Area	Elaboration of Contents	Hrs.
1	Introduction to power system	1.1 Introduction to power system. 1.2 Concepts on per reactance and Per unit and its need 1.3 Schematic layout of power system(generation, transmission and distribution unit)	8

		1.4 Single line diagram representation of power system	
2	Economics of Generation	2.1 Economics of Generation: 2.1 1Fixed and operating cost of Electrical Energy Generated 2.1.2 Load curves, Base load, peak load and load Estimation 2.1.3 variable load problems: Demand factor, Load factor, Diversity factor, Power factor and their effect on cost of generation 2.2Inter-connection of power stationsand its advantages, concept of regional and national grid.	10
3	Power Plants	3.1 Introduction of power plant 3.2 Types of power plants 3.3.1 Diesel power plant: working principle and layout diagram, different components in short version 3.3.2 Hydro power plants: working principle and layout diagram, different components in detail 3.3.3Thermal power plant: Working principle and layout diagram, different components in short version	18
4	Power system operation	4.1 Normal and Abnormal conditions in power system 4.2Relation between Voltage-Reactive power and its cause and effect 4.3 Relation between frequency-Active power and its cause and effect 4.4Need for Synchronization, 3-lamp methods and Automatic Synchronizer for Synchronization and system restoration 4.5 Droop characteristics for power sharing in synchronous generators 4.6 Hunting oscillation in generator, its causes and effects	14
5	Power factor	5.1 Definition	14

	improvement	6.2 Dis-advantages of low power factor 5.3 Causes of low power factor 5.4 Methods of power factor improvement . Use of static capacitor . Use of synchronous condenser. 5.5 Advantage of power factor improvement	
	Total		64

5. Suggested Practical and Project Works

Practical and project work is an integral part of technical and vocational subjects. They are carried out to consolidate the practical learning experiences. Some of the suggested practical and project work activities of this subject are mentioned below. As these are the basic and fundamental practical and project works, the teacher can adapt or introduce more relevant to their context and students' needs.

S.N.	**Grade 11**		
	Content Area	**Suggested Practical Activities**	**Hrs.**
1	Introduction to power system	1.1 Draw single line diagram of a power system. 1.2 Draw a schematic layout of a power system.	**12**
2	Economics of generation	2.1 Prepare a report on interconnection of power stations.	**12**
3	Power plants	3.1 Visit a nearest diesel power plant and prepare a report of layout of power system. **3.2** Visit a nearest hydropower plant and prepare a report of layout of power system. **3.3** Visit a nearest thermal power plant and prepare a report of layout of power system.	**12**
4	Power system operation	4.1 Understanding the auto-synchronizer or 3 lamp method of synchronization and prepare a short report of it. 4.2 Visit to a nearest hydro power station to observe	**16**

		power system operation.	
5	Power factor improvement	5.1 Study of static capacitor bank and synchronous condenser. 5.2 Observe power factor improvement practices in nearby commercial or industrial buildings.	**12**
	Total		**64**

6. Learning Facilitation Process

This course intends to provide both theoretical as well as practical knowledge and skills on the subject, thereby, blends with both theoretical and practical facilitation strategies to ensure better learning. In fulfilling the learning outcomes stated in the curriculum, the teacher should use a variety of methods and techniques that fit to the contents. In particular, the following methods, techniques and strategies are used for learning facilitation:

- Demonstration
- Case study
- Questionnaire
- Practical Works
- Audio/Visual use from different sources
- Project Works
- Problem Solving
- Exploration
- Discussion
- Group works and pair works

7. Student Evaluation

Evaluation is an integral part of learning process. Both formative and summative modes of evaluation are emphasized. Formative evaluation will be conducted so as to provide regular feedback for students, teachers and parents/guardians about how student learning is. Class tests, unit tests, oral question-answer, home assignment etc, are some ways of formative evaluation.

There will be separate evaluation of theoretical and practical learning. Summative evaluation embraces theoretical examination, practical examination and evaluation of research work or innovative work.

(a) Internal Evaluation

Internal evaluation covers 50 Percent weight age. Internal evaluation consists of Practical Activities (Practical works and projects works) (35 Percent), (b) Marks from trimester examinations (10 Percent), and (c) Classroom participation (5 Percent). Practical work should be based on list of activities mentioned in this curriculum. Project works should be based on the mentioned lists or created by teachers. Mark distribution for internal evaluation (practical work and project work) will be as follows:

S.N.	Mani activities	Activities in detail	Percent
1	Participation	Participation in attendance, homework, classwork, project work, practical works etc.	5
2	Practical work	Conduction of practical work activities	15
		Record keeping of practical work activities	3
3	Project work	Conduction of project work activities	10
		Record keeping of project work activities	2
4	Viva	Viva of practical work and project work activities	5
6	Internal exam	First trimester 5 marks and Second trimester 5 marks	10
Total			50

Note:

(i) Practical examination will be conducted in the presence of internal and external supervisors. Evaluation of experiment will focus both the product of work and skills competencies of student in using apparatus.

(ii) Project work assessment is the internal assessment of reports and presentation of their project works either individually or group basis. In case of group presentation, every member of the group should submit a short reflection on the

presented report in their own language. Records of project works must be attested by external supervisor.

(b) External Evaluation

Theoretical evaluation covers 50% of the weight. The tool for external evaluation of theoretical learning will be a written examination. Questions for the external examination will be based on the specification grid developed by Curriculum Development Centre. Examination question paper will be developed using various levels of revised Bloom's taxonomy including remembering level, understanding level, application level and higher ability (analyzing, evaluating, creating).

Specification Grid, 2078

Grade: 11 Subject: Electrical Power System Time: 2 hrs.

Unit	Content	Credit hrs.	Knowledge and Understand			Application			Higher Ability			Total Question Number			Total Question	Marks Weight			Total Marks
			MCQ	Short	Long	MCQ	Short	Long	MCQ	Short	Long	MCQ	Short	Long		MCQ	Short	Long	
1	Introduction to power system	8																	6
2	Economics of Generation	10																	6
3	Power Plants	18																	16
4	Power system operation	14																	12
5	Power factor improvement	14																	10
			5	2	1	4	2	1	0	1	0	9	5	2	16	9	25	16	
	Total	64	5	2	1	4	2	1	0	1	0	9	5	2	16	9	25	16	50

Repair and Maintenance of Electrical Equipment

Grades: 11 **Credit hrs: 4** **Working hrs: 128**

1. Introduction

This is technology level subject with application in Industry, commercial buildings and public utility departments such as electricity authority, Telecom authority, Irrigation, Water supply and Sewage board etc. After studying this subject student will be able to inspect, test and repair electrical machines as per standards. They will be able to carry out routine and preventive maintenance of electrical machines; possesses knowledge of safety rules, safety of machines and persons and prevention of accident resulting their ability for total productive maintenance.

This curriculum comprises of the contents like: scope and organization of electrical maintenance department, maintenance and testing of electrical equipment, maintenance and troubleshooting of rotating machines, maintenance and repair of transformers, maintenance and testing of insulation, maintenance and repair of overhead distribution lines and underground cables and rewinding of single phase stator.

The curriculum prepared in accordance with National Curriculum Framework is structured in such a way that it incorporates the level-wise competencies, grade-wise leaning outcomes, scope and sequence of contents, suggested practical/project activities, learning facilitation process and assessment strategies so as to enhance the learning on the subject systematically.

2. Competencies

On completion of the course, the students will have the following competencies:

1. Understand the scope and maintenance of electrical maintenance department
2. Carry out maintenance and testing of electrical equipment
3. Have basic skills on the maintenance and repair of AC and DC machines
4. Carry out maintenance and testing of insulation
5. Understand the system of maintenance of overhead distribution line and underground cables.

6. Perform rewinding of single phase stator of induction motors.

3. Grade-wise Learning Outcomes

S.N.	Content Area	Learning Outcomes
1	**Scope and Organization of Electrical maintenance Department**	1.1 List out the objectives of Electrical maintenance Department. 1.2 List out the functions of Electrical Maintenance Department. 1.3 List out the organization work of Electrical Maintenance Department. 1.4 Describe the office work of Electrical Maintenance Department. 1.5 Write the technical details for maintenance work. 1.6 Put the maintenance record. 1.7 Prepare a model of job card and log book. 1.8 Put machine history card.
2	**Maintenance and Testing of Electrical Equipment**	2.1 Describe the fundamentals of maintenance 2.2 Explain the importance of electrical maintenance. 2.3. Describe the concept of routine, preventive & breakdown maintenance. 2.4. Describe the preventive maintenanceof Earthing System, Low Voltage Circuit Breakers, Medium Voltage Circuit Breakers and batteries and use basic skills on work. 2.9. Describe the general procedure for overhaul of motors and apply basic skills. 2.10. Have testing of electrical equipment.
3	**Maintenanceand Troubleshooting of Rotating Machines**	3.1. Use the skills of maintenance of rotating machines 3.2. Use troubleshooting skills of rotating machines.

4	**Maintenance and Repair of Transformers**	4.1. Identify the fault occurrence in the different parts of transformers 4.2. Check out the list of maintenance of power transformers. 4.3. Apply the preventive maintenance & routine maintenance of distribution transformer. 4.4. Have an inspection & maintenance schedule for distribution transformers. 4.5. Use the skills for testing of transformers.
5	**Maintenance and Testing of Insulation**	5.1 Classify of insulating materials. 5.2 Take a measurement of Insulation resistance. 5.3 Explain the factors affecting the life of insulating materials. 5.4 Describe and use the skills of the methods of cleaning of insulation 5.5 Have drying and re-varnishing of insulation. 5.6 Insulate Oil and describe its Characteristics. 5.7 List out the causes of deterioration of insulating oil. 5.8 List out the types of test on insulating oil
6	**Maintenance and Repair of Overhead Distribution Lines and Underground Cables**	6.1. Apply the safety procedures for maintenance of overhead lines. 6.2. Use the skills of maintenance of overhead lines. 6.3. Find Faults in overhead lines. 6.4 Mention the procedure to be followed for Shut down in overhead lines. 6.5. List out the repairing tools. 6.6. Repair of Overhead Lines (Inspection of insulators, joints, earth wires, etc.) (IS: 561). 6.7. Find the faults in underground cables. 6.8. Apply the skills of cable jointing techniques.

		6.9. Repair the cables.
7	**Rewinding of Single Phase Stator**	7.1. Explain the capacitor start motor, running and starting winding, capacitor centrifugal switch. 7.2. Name plate data – power output voltage, frequency, connection, full load, phase, number full load current insulation type, manufacture model no. 7.3. Rewind of a single phase stator. 7.3. Rewind of a three phase stator.

4. Scope and Sequence of Contents

S. N.	Content Area	Elaboration of Contents	Hrs.
1	**Scope and Organization of Electrical maintenance Department**	**1.1** Introduction **1.2** Objectives of Electrical maintenance Department 1.3 Functions of Electrical Maintenance Department 1.4 Organization work of Electrical Maintenance Department 1.5 Office work of Electrical Maintenance Department 1.6 Technical details for Maintenance work 1.7 Maintenance Record 1.8 Job card and log book 1.9 Machine History card **1.10** Permit To Work(PTW) system	**4**
2	**Maintenance and Testing of Electrical Equipment**	2.1 Fundamentals of Maintenance 2.2 Importance of Electrical Maintenance 2.3. Concept of routine, preventive & breakdown maintenance 2.4. Preventive maintenance	**6**

		2.4.1. Advantages of preventive maintenance 2.4.2. Elements of Preventive Maintenance 2.4.3. Procedure for developing preventive maintenance schedule 2.4.4. Common troubles in equipment and machines 2.4.5. Internal and external causes of failure of equipment 2.4.6. List of commonly used instruments and tools for maintenance: Bearing puller, Filler gauge, dial indicator, spirit level, megger, earth tester, growler, and multimeter. 2.4.7. Precautions on handling the tools 2.5. Preventive maintenance of Earthing System 2.6. Preventive maintenance of Low Voltage Circuit Breakers 2.7. Preventive maintenance of Medium Voltage Circuit Breakers 2.8. Preventive maintenance of Batteries 2.9. General procedure for Overhaul of motors 2.10. Testing of Electrical Equipment 2.10.1. Objectives of testing of electrical equipment 2.10.2. Concept of routine tests, type tests and special tests 2.10.3. Test of single & three phase Induction motors (Insulation Resistance Test, High Voltage Test, Resistance Measurement Test, No Load Test, Open Circuit Test, Locked Rotor Test, Temperature Rise Test, Measurement of	

		Noise) 2.10.4. Test of heating household appliances(Open circuit, short circuit and Earth Leakage test)	
3	**Maintenanceand Troubleshooting of Rotating Machines**	3.1. Maintenance of Rotating Machines 3.1.1. Visual Inspections of Generators and Motors 3.1.2 Audio Inspections of Generators and Motors 3.1.3. Maintenance of Motors without dismantling 3.1.4. Preventive maintenance of Induction motors 3.1.5. Maintenance schedule of Induction motors 3.1.6. Preventive maintenance for Alternators 3.1.7. Maintenance schedule of Alternators 3.2. Troubleshooting of Rotating Machines 3.2.1. Faults in Rotating Machines 3.2.2. Abnormal conditions in Rotating machines and their effects 3.2.3. Troubleshooting of Low Voltage Induction motors 3.2.4. Troubleshooting of Squirrel Cage Induction motors 3.2.5. Troubleshooting of Slip Ring Induction motors 3.2.6. Troubleshooting of Alternators 3.2.7. Troubleshooting of DC Motors 3.2.8. Troubleshooting of DC Generators	**14**

4	**Maintenance and Repair of Transformers**	4.1. Fault Occurrence in the different parts of Transformers: Tank, Core, winding, conservator, radiators, bushings, terminals, temperature measurement system, safety valves, tap changers and accessories/ fittings etc. 4.2. Factors affecting the life of transformer- moisture, water oxygen, solid impurities, varnish, slackness of windings and dust. 4.3. Check list of maintenance of power transformers 4.4. Preventive maintenance & routine maintenance of distribution transformer 4.5. Inspection & Maintenance Schedule for Distribution Transformers 4.6. Guide to Testing of Transformers Routine Tests 4.6.1 Measurement of winding insulation resistance 4.6.2 Measurement of voltage ratio and check of phase displacement 4.6.3 Measurement of short-circuit impedance and load loss 4.6.4 Measurement of no-load loss and current 4.6.5 Dielectric routine tests 4.6.6 Tests on on-load tap-changers Type Tests ➢ Temperature-rise test ➢ Dielectric type tests Special Tests	**12**

		➢ Dielectric special tests ➢ Short-circuit withstand ➢ Determination of sound levels ➢ Breakdown Voltage(BDV) and moisture content of Transformer oil test	
5	**Maintenance and Testing of Insulation**	5.1 Classification of insulating materials 5.2 Measurement of Insulation Resistance i.Insulation Resistance Meters i.Voltmeter method i.Short Insulation Resistance Test v.Dielectric Absorption Test 5.3 Factors affecting the life of insulating materials 5.4 Methods of cleaning of Insulation 5.5 Drying and Re-varnishing of Insulation 5.6 Insulating Oil and its Characteristics 5.7 Causes of deterioration of Insulating Oil 5.8 Types of Test on Insulating Oil i.Dielectric Strength Test i.Crackle Test i.Acidity Test v.Sludge Test v.Fast point Test 5.9 Purification of insulating oil 5.10 Protection of electrical insulation during the Hrs. of inactivity	**6**
6	Maintenance and Repair of Overhead Distribution Lines	6.1. Safety procedures for maintenance of Overhead lines Authorized persons, danger notice, caution notice, permit to work, arranging of shutdowns	**10**

	and Underground Cables	personally, temporary earthing, cancellation of permit and Restoration of supply 6.2. Maintenance of Overhead Lines Routine inspection of Overhead Lines Patrolling of Overhead Lines Inspection of Overhead lines from pole top - points to be noted during patrolling from ground; special inspections and emergency inspections 6.3. Faults in Overhead Lines 6.4 Procedure to be followed for Shut down in Over head lines 6.5. List of Repairing Tools 6.6. Repairing of Overhead Lines (Inspection of insulators, joints, earth wires, etc.) (IS: 561) 6.7. Faults in Underground Cables 6.8. Cable Jointing Techniques 6.9. Repairing of Cables	
7	Rewinding of Single Phase Stator	Rewinding – stator of motor 7.1. Capacitor start motor, running and starting winding, capacitor centrifugal switch. 7.2. Name plate data – power output voltage, frequency, connection, full load, phase, number full load current insulation type, manufacture model no. 7.3. No of poles: Pitch of coil – no of slots that each coil spans 7.4. No of turns in each coil • Size of wire in each winding • Kind of connection (series- parallel) • Position of windings in relation to other	**12**

		windings 7.5. Type of winding (hand, form skein) 7.6. Slot insulation both size and kind • Number of slots • Stripping the stator • Magnet wires (enamel wire) • Slots insulation – insulation class, insulation material, size cuffed ends 7.7. Rewinding- hand rewinding, form winding, skein winding 7.8. Connection of winding – single voltage, double voltage series parallel recognize the connection 7.9. Splicing and taping leads 7.10. Testing new winding 7.11. Backing and varnishing	
	Total		**64**

5. Suggested Practical and Project Works

The practical and project works are integral parts of reinforcing the students' learning. So the new curriculum provisions the practical and projects works as a part of curriculum. Some of the sample practical and project works are suggested herewith. However, a teacher can adapt them or use similar other project works as per their students need and specific context.

S.N.	**Grade 11**		
	Content Area	**Suggested Practical Activities**	**Hrs.**
1	**Scope and Organization of Electrical maintenance**	1.1 Visit to a nearby maintenance department of an industry. 1.2 Prepare a sample of Maintenance Record. 1.3 Prepare a sample of Job card and log book.	**4**

	Department	1.4 Prepare a sample of a Machine History card. **1.5** Prepare a sample of a Permit to Work(PTW) system.	
2	**Maintenance and Testing of Electrical Equipment**	2.1. Preventive maintenance of Earthing System 2.2. Preventive maintenance of Low Voltage Circuit Breakers 2.3. Preventive maintenance of Medium Voltage Circuit Breakers 2.4. Preventive maintenance of Batteries 2.5. General procedure for Overhaul of motors 2.6. Testing of Electrical Equipment	**6**
3	**Maintenanceand Troubleshooting of Rotating Machines**	3.1. Maintenance of Single phase induction motors 3.2. Prepare a chart of Troubleshooting of Rotating Machines 3.3. Visit to a nearby industry to observe and study the maintenance and troubleshooting of rotating machines 3.4 Short term internship in an industry to understand the procedures of maintenance and troubleshooting of rotating machines	**9**
4	**Maintenance and Repair of Transformers**	4.1. Prepare a Check list of maintenance of power transformers. 4.2. Prepare a Check list of Preventive maintenance & routine maintenance of distribution transformer. 4.3. Visit to a nearby transformer repairing center or a distribution center to observe and study the maintenance and troubleshooting of transformers. 4.4 Short term internship in Distribution centers or	**9**

		repairing centers to understand the procedures of maintenance and troubleshooting of transformers	
5	**Maintenance and Testing of Insulation**	5.1 Perform cleaning of Insulation. 5.2 Drying and Re-varnishing of Insulation 5.3 Check the quality of Insulating oil 5.4 Test on Insulating Oil 5.5. Visit to a nearby distribution centers to observe and study the maintenance and troubleshooting of insulators.	**8**
6	**Maintenance and Repair of Overhead Distribution Lines and Underground Cables**	6.1. Maintenance of Overhead Lines 6.2. Cable Jointing Techniques 6.3. Repairing of Cables 6.4. Practice of patrolling of overhead lines 6.5 Visit to a nearby Repairing workshops of Distribution centers.	**8**
7	**Rewinding of Single Phase Stator**	Rewinding – stator of motor 7.1. Rewinding of a single phase stator 7.2. Rewinding of a three phase stator	**20**
	Total		**64**

6. Learning Facilitation Process

This course aims to blend both theoretical and practical aspects of knowledge and skills required in the subject. So, its facilitation process differs from the traditional method of delivery. The practical aspect is much more focused. So, methods and strategies that enable the practical skills in the students are much used in course of content facilitation. A facilitator encourages and assists students to learn for themselves engaging in different activities with practical tasks. To achieve the entire objectives from this syllabus, the teacher must use different techniques and process while teaching. In

particular, the teacher can make use of the following methods and strategies for the learning facilitation:

- Discussion
- Demonstration
- Problem solving
- Presentation
- Case study
- Practical works
- Project works
- Field study
- Group works and pair works
- Exploration

7. Student Evaluation

Evaluation is an integral part of learning process. Both formative and summative modes of evaluation are emphasized. Formative evaluation will be conducted so as to provide regular feedback for students, teachers and parents/guardians about how student learning is. Class tests, unit tests, oral question-answer, home assignment etc, are some ways of formative evaluation.

There will be separate evaluation of theoretical and practical learning. Summative evaluation embraces theoretical examination, practical examination and evaluation of research work or innovative work.

(a) Internal Evaluation

Internal evaluation covers 50 Percent weight age. Internal evaluation consists of Practical Activities (Practical works and projects works) (35 Percent), (b) Marks from trimester examinations (10 Percent), and (c) Classroom participation (5 Percent). Practical work should be based on list of activities mentioned in this curriculum. Project works should be based on the mentioned lists or created by teachers. Mark distribution for internal evaluation (practical work and project work) will be as follows:

S.N.	Mani activities	Activities in detail	Percent
1	Participation	Participation in attendance, homework, classwork, project work, practical works etc.	5
2	Practical work	Conduction of practical work activities	15
		Record keeping of practical work activities	3
3	Project work	Conduction of project work activities	10
		Record keeping of project work activities	2
4	Viva	Viva of practical work and project work activities	5
6	Internal exam	First trimester 5 marks and Second trimester 5 marks	10
Total			50

Note:

(i) Practical examination will be conducted in the presence of internal and external supervisors. Evaluation of experiment will focus both the product of work and skills competencies of student in using apparatus.

(ii) Project work assessment is the internal assessment of reports and presentation of their project works either individually or group basis. In case of group presentation, every member of the group should submit a short reflection on the presented report in their own language. Records of project works must be attested by external supervisor.

(b) External Evaluation

There will be an external theoretical evaluation which covers 50% of the curricular weight. The tool for external evaluation of theoretical learning will be a written examination. Questions for the external examination will be based on the specification grid developed by Curriculum Development Centre. Examination question paper will be developed using various levels of revised Bloom's taxonomy including remembering level, understanding level, application level and higher ability (analyzing, evaluating, creating).

Specification Grid, 2078

Grade: 11 Subject: Repair and Maintenance of Electrical Equipment Time: 2 hrs.

Unit	Content	Credit hrs.	Knowledge and Understand			Application			Higher Ability			Total Question Number			Total Question	Marks Weight			Total Marks
			MCQ	Short	Long	MCQ	Short	Long	MCQ	Short	Long	MCQ	Short	Long		MCQ	Short	Long	
1	Scope and Organization of Electrical maintenance Department	4																	2
2	Maintenance and Testing of Electrical Equipment	6																	5
3	Maintenanceand Troubleshooting of Rotating Machines	14																	11
4	Maintenance and Repair of Transformers	12																	10
5	Maintenance and Testing of Insulation	6																	2
6	Maintenance and Repair of Overhead Distribution Lines and Underground Cables	10																	9
7	Rewinding of Single Phase Stator	12	6	2	0	3	2	1	0	1	1	9	5	2	16	9	25	16	11
	Total	64	6	2	0	3	2	1	0	1	1	9	5	2	16	9	25	16	50

Switchgear and Protection

Grades: 12 **Credit hrs: 4** **Working hrs: 128**

1. Introduction

The curriculum 'Switchgear and Protection' is designed to develop the students the understanding of the principles and working of protective switchgear so that they can handle, install and maintain them and also take decisions in different situations. This subject teaching requires reinforcement from visits to substations, power stations and well-designed laboratory experiences. Therefore, a practical orientation to the teaching of this subject is suggested in this subject.

This curriculum comprises the contents like: an introduction to control and protection system, isolators and contactors, current and potential transformers, circuit breakers, relays, protection schemes, Earthing and overvoltage protection. The course is blended with theoretical as well as practical subject content, thereby; the pedagogical approaches in delivering the course should consider the balance between theory and practice.

The curriculum is structured in accordance with National Curriculum Framework, 2076. It focuses on both theoretical and practical aspects having equal teaching and practical. It incorporates the level-wise competencies, grade-wise leaning outcomes, scope and sequence of contents, suggested practical/project activities, learning facilitation process and assessment strategies so as to enhance the learning on the subject systematically.

2. Competencies

On competition of the course, the students will have the following competencies:

1. Explain the different types of fault in power system.
2. Observe the constructional details of fuses, MCB, MCCB, ELCB, RCCB, isolators, CT and PT
3. Identify, select and operate fuses, MCB, MCCB, ELCB, RCCB, isolators, CT and PT
4. Compare different kinds of circuit breakers

5. Observe constructional details of various types of relays and protection systems used in electrical power supply systems and industrial plants
6. Operate, identify and select various types of relays and protection systems used in electrical power supply systems and industrial plants
7. Apply the protection schemes of power system components
8. Describe the earthing system for industrial and commercial installations

3. Grade-wise Learning Outcomes

S.N.	Content Area	Learning Outcomes
1	**Faults in a Power System**	1.1 Mention the types of faults. 1.2 Identify the unsymmetrical faults: L-to-L, L-to-G and L-L-to-G faults 1.3 Identify the sort circuits and their effects. 1.4 Prepare a representation of fault conditions through single line diagrams. 1.5 Have nominal ratings and fix abnormal conditions of electrical equipment.
2	**Switchgear**	2.1 Identify Switchgear and apply the skills for its protection. 2.2 Describe the characteristics of fuses. 2.3. Mention the types of fuse. 2.4 Describe switches and their types. 2.5 Describe contactors, LV Circuit Breakers. 2.7. Introduce to ELCB and RCCB and their applications
3	**Current and Potential Transformers**	3.1 Introduce potential transformers and current transformers.
4	**Circuit Breakers**	4.1 Introduce the basic operating principles, arc phenomena and arc extinction in circuit breakers. 4.2. Differentiate between Isolator and Circuit breaker. 4.3Describe the classification, construction, operating

		principles and applications of different circuit breakers 4.5 Make a comparison between various types of circuit breakers in terms of their features and application areas.
5	**Relays**	5.1 Classify relays. 5.2 Introduce electromagnetic relays. 5.3 Introduce directional relays. 5.4 Introduce buchholz relay.
6	**Protection Schemes of Generators, Transformers, Motors and Feeders**	6.1 Describe the protection of alternators. 6.2 Explain about the protection of power transformer. 6.3 Explain about the motor protection. 6.4 Explain about the protection of feeders.
7	**Different Components of Sub-stations**	7.1 Describe substations.. 7.2 Describe earthing of a substation. 7.3 Introduce the concept of G.I.S. (Gas Insulated Substation).
8	**System Earthing and Overvoltage Protection**	8.1 Introduce Earthing. 8.2 List out the causes of over-voltages in electricity supply system. 8.3 Introduce overvoltage protection. 8.4 Introduce neutral earthing. 8.5 Introduce substation earthing.

4. Scope and Sequence of Contents

S. N.	Content Area	Content	Hrs.
1	**Faults in a Power System**	1.1 Types of faults: symmetrical faults and unsymmetrical faults 1.2 Unsymmetrical faults: L-to-L, L-to-G and L-L-to-G faults 1.3 Short circuits and their effects	**4**

		1.4 Representation of fault conditions through Single Line Diagrams 1.5 Nominal ratings and abnormal conditions of electrical equipment	
2	**Switchgear**	2.1 Switchgear and Protection Definition of Switchgear and Protection Components of Switchgear Purpose of Protective gear Characteristics of a protection system Need for control and protection of electricity supply systems 2.2 Characteristics of Fuses Advantages and disadvantages of fuse Desirable characteristics of fuse element, fuse element materials Important terms related to fuse: Current rating of fuse element, fusing current, fusing factor, cut-off current, arcing time and breaking capacity 2.3. Types of fuse: LV fuse and HV fuse LV fuse: Rewirable fuse and HRC fuse-their construction and working HV fuse: Expulsion type & Drop Out fuses-their construction & working 2.4 Switches and their types: Air Switch, Oil Switch and Earth Switch Load Breaking Switch Isolators (Disconnectors): Construction, operating principles and their selection; applications 2.5 Contactors: Types, construction and operation of Contactors Control and protection of circuits using contactors	**8**

		Applications of Contactors 2.6. LV Circuit Breakers: MCB and MCCB Construction and working of MCB and MCCB Standard ratings of MCB and MCCB 2.7. Introduction to ELCB and RCCB and their applications	
3	**Current and Potential Transformers**	3.1 Potential transformers: Construction, operating principles, characteristics, standard ratios, burden, errors and applications; common faults and their detection techniques 3.2 Current transformers: Construction, operating principles, characteristics, standard ratio, errors, burden, errors and applications; common faults and safety precautions to be taken when working with energized CTs.	**6**
4	**Circuit Breakers**	4.1 Introduction, basic operating principles, arc phenomena and arc extinction in circuit breakers, duties of circuit breakers 4.2. Differences between Isolator and Circuit breaker 4.3. Circuit breaker rating: breaking capacity, making capacity and short-time rating 4.4. Classification, construction, operating principles and applications of circuit breakers: 1. Air break circuit breakers 2. Oil circuit breakers 3. Air blast circuit breakers 4. Vacuum circuit breakers 5. SF6 circuit breakers 4.5 Comparison between various types of circuit breakers in terms of their features and application areas	**12**
5	**Protective**	5.1. Introduction to Protective Relays	**8**

	Relays	5.2. Classification of relays on the basis of construction: electromagnetic, static and numerical relays 5.3. Electromagnetic relays: Construction, operating principles and classifications based on characteristics (Instantaneous relays, inverse relays, IDMT relays), Plug setting and time setting of relays 5.4. Basic Concept of Directional relays 5.5. Basic Concept of Distance relay and its types 5.6. Differential Protection 5.5. Introduction to Numerical Relays	
6	**Protection Schemes of Generators, Transformers, Motors and Feeders**	6.1 Protection of alternators, stator faults, rotor faults, mechanical conditions, external faults - their reasons, effect and protections used 6.2 Protection of power transformer: Types of faults and protective schemes: Over current, Earth fault, Differential protection, Buchholz devices, Winding Temperature Protection 6.3 Motor protection: Types of faults and protection in motors, thermal relays, protection of small motors, under voltage protection 6.4 Protection of feeders: radial, parallel and ring feeders protection, directional time and current graded schemes, differential protection	**12**
7	**Different Components of Sub-stations**	7.1Substations 7.1 Layout and single line diagram of a substation 7.1.2 Busbar arrangements of a substation 7.1.3 Reactors: types of reactors uses of reactors 7.1.4 Capacitor banks 7.2 Earthing of a substation 7.2.2. Neutralgrounding:- types of grounding (solid grounding, reactance grounding	**4**

		7.2.3. Grounding of sub-stations, grounding of line structure and substation equipment 7.3 Concept of G.I.S. (Gas Insulated Substation)	
8	**System Earthing and Overvoltage Protection**	8.1 Earthing: Definition, purposes, classification, methods of earthing, earthing resistance 8.2. Classification of Neutral or System earthing: Isolated neutral, Solidly grounded neutralearthing, Resistance earthing, Reactance earthing and Peterson coil earthing 8.3. Substation earthing: safe value of current through human body, soil resistivity and resistance, step and touch potential, grounding methods in substations 8.4 Definition of Overvoltage; Causes of over-voltages in electricity supply system: Internal and external overvoltage 8.5. Overvoltage protection: Transmission Line and substation protection against over-voltages 8.6. Overhead Earth wire, angle of protection, lightning arrestor, Horn gap, Rod gap and Metal Oxide Lightning Arrestors; Surge Absorbers	**10**
	Total		**64**

5. Suggested Practical and Project Works

The practical work that students do during their course is aimed at providing them learning opportunities to accomplish competency of the curriculum as well as reinforcing their learning of the theoretical subject content. Similarly, involving in a project work fosters the self-learning of students in the both theoretical and practical contents. As this subject emphasizes to develop both theoretical and practical knowledge and skills, some of the practical and project works are suggested for the students. However, the tasks presented here are the samples only. A teacher can assign the extra practical and project works as per the students' need or specific context.

S.N.	Grade 12		
	Content Area	**Practical Activities**	**Hrs.**
1	**Faults in a Power System**	1.1 Draw a single line diagram of a power system with standard IEC Symbols. 1.2 Represent faults in a SLD. 1.3 Case Study of fires due to short circuits	**4**
2	**Switchgear**	2.1 Identify different components of protection system in electricity supply systems. 2.2 Study of LV and HV fuses 2.3 Plot the operating characteristics of LV fuses and CBs 2.4 Observe the coordination of fuses. 2.5 Demonstration of protective devices	**8**
3	**Current and Potential Transformers**	3.1 Identify terminals and carry out polarity test and ratio test for a potential transformer. 3.2 Identify terminals and carry out polarity test and ratio test for a current transformer. 3.3 Connections of CT and PT in a panel board	**4**
4	**Circuit Breakers**	4.1 Study of Air Blast Circuit breaker 4.2 Study of MOCB&BOCB 4.3 Study of SF6 Circuit breaker 4.4 Study of Vacuum Circuit Breaker 4.5 Visit to a nearby switchyard to see the maintenance and performances of CB	**6**
5	**Protective Relays**	5.1 Observation of characteristics of Instantaneous relay 5.2 Study the construction of IDMT over-current relay 5.3 Study and plot Time-Current characteristics at various multiples of plug setting current in IDMT over current relay	**6**

		5.4 Identify the terminals of numerical relays 5.5 Visit to a nearby substation to observe the performance of relay	
6	**Protection Schemes of Generators, Transformers, Motors and Feeders**	6.1 Study the protection schemes of nearby substation 6.2 Study the parts of a Buchholz relay 6.3 Study the protection scheme of a power transformer 6.4 Study of design of a protection system for feeders, generators and transformers 6.5 Visit to a nearby small hydropower for detail observation of protection schemes	**12**
7	**Different Components of Sub-stations**	7.1 Study of arrangement of different components in a substation 7.2 Study the types of bus bar arrangement 7.3 Draw a SLD of a 66/11 KV substation and 11/0.4 KV substation 7.4 A project work on building a model of substation 7.5 A field visit to a nearby substation	**12**
8	**System Earthing and Overvoltage Protection**	8.1 Use earth tester to find out the soil resistivity 8.2 Use earth resistance tester to calculate earth resistance 8.3 Study of different kinds of lightning arrestors 8.4 Visit to a nearby substation to see overvoltage protection in a substation	**12**
	Total		**64**

6. Learning Facilitation Process

Learning facilitation process is determined according to the content to be dealt in the subject. It's also an art of teacher. The teacher should utilize such teaching methods and techniques that are appropriate to the contents and needs of the students. In facilitating the course, various approaches, methods and techniques are used. To be particular, the following major methods and strategies are used in this subject:

- Discussion
- Problem solving
- Demonstration
- Presentation
- Case study
- Practical works
- Project works
- Field study
- Group works and pair works
- Questionnaire
- Exploration

7. Student Evaluation

Evaluation is an integral part of learning process. Both formative and summative modes of evaluation are emphasized. Formative evaluation will be conducted so as to provide regular feedback for students, teachers and parents/guardians about how student learning is. Class tests, unit tests, oral question-answer, home assignment etc, are some ways of formative evaluation.

There will be separate evaluation of theoretical and practical learning. Summative evaluation embraces theoretical examination, practical examination and evaluation of research work or innovative work.

(a) Internal Evaluation

Internal evaluation covers 50 Percent weight age. Internal evaluation consists of Practical Activities (Practical works and projects works) (35 Percent), (b) Marks from trimester examinations (10 Percent), and (c) Classroom participation (5 Percent). Practical work

should be based on list of activities mentioned in this curriculum. Project works should be based on the mentioned lists or created by teachers. Mark distribution for internal evaluation (practical work and project work) will be as follows:

S.N.	Mani activities	Activities in detail	Percent
1	Participation	Participation in attendance, homework, classwork, project work, practical works etc.	5
2	Practical work	Conduction of practical work activities	15
		Record keeping of practical work activities	3
3	Project work	Conduction of project work activities	10
		Record keeping of project work activities	2
4	Viva	Viva of practical work and project work activities	5
6	Internal exam	First trimester 5 marks and Second trimester 5 marks	10
Total			50

Note:

(i) Practical examination will be conducted in the presence of internal and external supervisors. Evaluation of experiment will focus both the product of work and skills competencies of student in using apparatus.

(ii) Project work assessment is the internal assessment of reports and presentation of their project works either individually or group basis. In case of group presentation, every member of the group should submit a short reflection on the presented report in their own language. Records of project works must be attested by external supervisor.

(b) External Evaluation

Theoretical evaluation covers 50% of the weight in this subject. The tool for external evaluation of theoretical learning will be a written examination. Questions for the external examination will be based on the specification grid developed by Curriculum Development Centre. Examination question paper will be developed using various levels of revised Bloom's taxonomy including remembering level, understanding level, application level and higher ability (analyzing, evaluating, creating).

Specification Grid

Grade: 12 Subject: Switchgear and Protection Time: 2 hrs.

Unit	Content	Credit hrs.	Knowledge and Understand			Application			Higher Ability			Total Question Number			Total Question	Marks Weight			Total Marks
			MCQ	Short	Long	MCQ	Short	Long	MCQ	Short	Long	MCQ	Short	Long		MCQ	Short	Long	
1	Faults in a Power System	4																	1
2	Switchgear	8																	6
3	Current and Potential Transformers	6																	5
4	Circuit Breakers	12																	10
5	Protective Relays	8																	6
6	Protection Schemes of Generators, Transformers, Motors and Feeders	12	4	2	0	5	2	1	0	1	1	9	5	2	16	9	25	16	10
7	Different Components of Sub-stations	4																	5
8	System Earthing and Overvoltage Protection	10																	7
	Total	64	4	2	0	5	2	1	0	1	1	9	5	2	16	9	25	16	50

Renewable Energy System

Grades: 12 **Credit hrs: 4** **Working hrs: 128**

1. Introduction

Renewable energy is defined as energy derived from resources that are regenerative or for all practical purposes cannot be depleted. Renewable energy, also called alternative energy, is generally thought of as an alternative to conventional energy usually supplied by the combustion of fossil fuel such as oil, coal or natural gas. The prime source of renewable energy is solar radiation. This curriculum aims to introduce the fundamental aspects of renewable energy system in general.

This curriculum covers a wide variety of contents like: conventional electricity generation, introduction to MHP, Layout and Electro-Mechanical Component of MHP Plant, operation and maintenance of MHP plant, introduction to solar energy, solar radiation, orientation and measurement, photovoltaic cell and performance parameters, PV System and its components and applications, operation and maintenance of photovoltaic system.

The curriculum prepared in accordance with National Curriculum Framework is structured in such a way that it incorporates the level-wise competencies, grade-wise leaning outcomes, scope and sequence of contents, suggested practical/project activities, learning facilitation process and assessment strategies so as to enhance the learning on the subject systematically.

2. Competencies

On completion of the course, the students will be enabled to:

1. Explain the types of renewable source of energy
2. Explain the micro hydro and photovoltaic energy conversion systems with their market potential and importance
3. Identify various components involved in both micro hydro and photovoltaic system

4. Operate a micro hydro plant and photovoltaic system and adopt suitable methods for their maintenance.

3. Grade wise learning Outcomes

S.N.	Content Area	Learning Outcomes
1	Renewable sources of Energy	1.1 Introduce renewable sources of energy. 1.2 Describe the features of renewable sources of energy. 1.3 Describe the role of renewable sources for rural development. 1.4 Identify current status of renewable sources plants in Nepal.
2	Introduction to micro hydro, its layout and civil construction works of MHP	2.1 Make a classification of hydro power plant by head and capacity. 2.2 Prepare a basic layout of a MHP plant. 2.3 Introduce the principle of power generation. 2.4 List out the civil components of MHP.
3	Electro-Mechanical Component of MHP Plant	1.1 Introduce turbine and valves. 1.2 Introduce synchronous and induction generators. 1.3 Introduce excitation system. 1.4 Introduce Speed governors and ELC. 1.5 Describe voltage control and AVR.
4	Protection System for MHP Plant	1.1 Introduce the types of protection used in MHP. 1.2 Explain the importance of earthing. 4.4 Apply th skills for the protection of generator and ELC from lightening stroke.
5	Operation and Maintenance of MHP Plant	1.1 Start up and shutdown procedure of MHP. 1.2 Apply the maintenance procedure for civil components of MHP. 1.3 Apply the maintenance procedure for electromechanical components of MHP.
6	Introduction to	8.5 Introduce sun and its energy.

	Solar Energy, Solar Radiation, Orientation and Measurement	8.6 Introduce some common terms used in solar PV system. 8.7 Explain the spectral distribution. 8.8 Mention the types of radiation. 8.9 Introduce solar radiation measuring and recording devices.
7	Photovoltaic Cell and Performance Parameters	7.1 Introduce working of PV cell. 7.2 Introduce I-V and P-V curves 7.3 Introduce electrical parameters of PV cells 7.4 Explain the factors affecting solar cell performance. 7.5 Describe bpass and blocking diode.
8	PV Technologies	8.1 Polycrystalline and and monocrystalline 8.2 Thin film technology 8.3 Advantages and disadvantages
9	PV System, its Components and applications	9.1 Describe the solar cell/ module/ array and mounting techniques. 9.2 Describe the storage batteries and its types. 9.3 Introduce Charge controller and its types 9.4 Introduce Inverters and its types and topologies. 9.5 Describe the isolated Pv systems. 9.6 Describe the grid connected pv systems. 9.7 Describe the PV systems for street lighting. 9.8 Describe the PV system for water pumping.
10	Operation and Maintenance of Photovoltaic System	10.1 Apply the skills of operation and maintenance of solar PV panels 10.2 Apply the skills of operation and maintenance of battery. 10.3 Apply the basic skills of operation and maintenance of charge controller. 10.4 Apply the basic skills of operation and maintenance of inverter.

4. Scope and Sequence of Contents

S.N.	Content Area	Elaboration of Content	Hrs.
1	Renewable sources of Energy	1.1 Introduction to Renewable sources of Energy 1.2 Types of renewable sources of Energy (wind, solar, hydro power plants, geothermal, biomass, fuel cells etc) 1.3 Features of Renewable sources of Energy 1.4 Role of Renewable sources for rural development 1.5 Current Status of different Renewable sources plants in context to Nepal	**3**
2	Introduction to micro hydro, its layout and civil construction works of MHP	2.1 Introduction 2.2 Classification of hydro power plant by head and capacity 2.3 Basic layout of a MHP plant 2.4 Introduce principle of power generation 2.5 Definition ofhead and discharge, Power equation 2.6 List Civil Components of MHP their constructional details and functions–intake and weir, desilting basin and spillway, forebay, Penstock, Power house and tail race	**6**
3	Electro-Mechanical Component of MHP Plant	3.1 Turbines and valves – Types of turbine and their working principle, turbines for MHP plants, types of valve used in MHP plant. 3.2 Synchronous generator–Basic construction and working principle, Excitation system. 3.3 Induction (asynchronous) generator - Basic construction and working principle, requirement of excitation capacitor. 3.4 Coupling of turbine and generator - Direct coupling,	**15**

		Belt drive, Flywheel. 3.5 Speed Governing – Hydraulic mechanical governor, Electronic Load Controller (ELC) – Basic operating principle 3.6 Voltage control – AVR for synchronous generator 3.7 Voltage control by VAR compensator	
4	Protection System for MHP Plant	4.1 Over speed protection 4.2 Over-load and short-circuit protection for generator 4.3 Over voltage and under voltage tripping system 4.4 Earthing for generator neutral and body 4.5 Protection of generator and ELC from lightening stroke 4.6 Single-line diagram of control panel with protectiondevices	**4**
5	Operation and Maintenance of MHP Plant	5.1 Starting up and shutdown procedure of MHP, training of operator. 5.2 Regular maintenance procedure for intake weir, canal, desilting basin and spillway, forebay, penstock, turbine, valve and generator. 5.3 Regular inspection and maintenance of control panel, switchgear and transformers	**4**

6	Introduction to Solar Energy, Solar Radiation, Orientation and Measurement	6.1 Introduction to Sun and its energy potential 6.2 Some common terms- Insolation, Solar Constant and Air Mass, Solar azimuth and Solar Elevation Angles 6.3 Spectral distribution, factors affecting spectral Distribution 6.4 Types of Radiation(direct, diffuse and reflected), Global Solar Radiation 6.5 Orientation and tilt angles for solar panels, latitude and longitude 6.6 Selecting optimum Tilt angle for solar panels 6.6 Pyranometer, its construction, working principle and calibration 6.7 Pryheliometer, its construction, working principle and calibration 6.8 Data logger, its function and block diagram	**6**
7	Photovoltaic Cell and Performance Parameters	7.1 Ideal and practical PV cell, their equivalent circuits, IV and P-V curves 7.2 Effect of series and parallel resistance on PV cell characteristics 7.2 Fill factor and efficiency 7.4 Series and parallel connection of PV cells 7.5 Factors affecting solar cell performance 7.5.1 Effect of cell temperature and Insolation on cell characteristics 7.5.2 Effect of humidity on output power 7.5.3 Shading and its impact on PV cell performance 7.6 Mitigation of shading impact (Use of bypass and blocking diode)	**6**

8	PV Technologies	8.1 Solar cells Generations 8.2 Crystalline silicon technology Monocrystalline and polycrystalline (m-Si, p-Si), advantages and disadvantages 8.2 Comparison between conventional and thin film Technology 8.4 Thin film technology (a:Si, CdTe, CIS), advantages and disadvantages	**4**
9	PV System, its Components and applications	9.1 Solar module/array, Various Components of a solar module 9.2 Connecting multiple solar modules (Series, Parallel, Series-parallel) 9.3 Commonly available solar modules in Nepal, Standard ratings 9.4 Array and its arrangement techniques 9.5 Mounts and mounting techniques (roof, ground and tracking) 9.6 Storage devices/batteries, types of batteries lead acid (tubular and flat-plate batteries), nickel cadmium, nickel iron, lithium-ion 9.7 Battery connection techniques (Series, Parallel, Series-Parallel combinations) 9.8 Charge controllers- PWM and MPPT charge controllers 9.3 Inverters (sine and square wave) 9.10 Different topologies of PV system, their advantages and disadvantages 9.11 Inverter topologies 9.11.1 Centralized 9.11.2 Master Slave 9.11.3 String	**12**

		9.11.4 Team-concept 9.11.5 Multi-String 9.11.6 Modular • Isolated PV system • PV system for street lighting • PV water pumping system	
10	Operation and Maintenance of Photovoltaic System	10.1 Regular cleanliness of solar panels 10.2 Checking battering overfill and prevent corrosion, testing of batteries 10.2 PV system safety measures during operation 10.4 PV module recycling and disposal 10.5 Operation and maintenance of Battery 10.6 Operation and maintenance of charge controller 10.7 Operation and maintenance of inverter	**4**
	Total		**64**

5. Suggested Practical and Project Works

Practical and project work is an integral part of technical and vocational subjects. They are carried out to consolidate the practical learning experiences. Some of the suggested practical and project work activities of this subject are mentioned below. As these are the basic and fundamental practical and project works, the teacher can adapt or introduce more relevant to their context and students' needs.

S.N.	**Grade 12**		
	Content Area	**Practical Activities**	**Hrs.**
1	Renewables sources of Energy	1.1 Study Renewable source of energy.	**5**
2	Introduction to micro hydro, its layout and civil construction works of MHP	2.1 Study civil components. 2.2 Introduce layout of MHP. 2.3 Head measurement of MHP 2.4 Discharge Measurement	**6**

		2.5 Power calculation	
3	Electro-Mechanical Component of MHP Plant	1.6 Study types of turbine. 1.7 Study working of Excitation system. 1.8 Study working of ELC 1.9 Study single line diagram of MHP 1.10 Experimental study on induction generator 1.10.1 Study of voltage build-up at no-load. 1.10.2 Operation with purely resistive load 3.6 Operation with inductive load and effect on terminal voltage	**8**
4	Protection System for MHP Plant	1.3 Study different types of protection used in MHP.	**5**
5	Operation and Maintenance of MHP Plant	1.4 Learn to start and stopping procedure for MHP. 1.5 Study maintenance procedure for civil components of MHP. 1.6 Study maintenance procedure for electromagnetic components of MHP.	**5**
6	Introduction to Solar Energy, Solar Radiation, Orientation and Measurement	6.1 Calculation of energy output from a solar panel under different Orientation and Tilt angles. 6.2 Measuring solar radiation using Pyranometer and comparing the result with solar constant and determine the radiation loss. 6.3 Study the use of Data Logger on a real system.	**6**
7	Photovoltaic Cell and Performance	7.1 Drawing I-V curve of PV pannels 7.2 Testing PV cells, its IV curve using variable	**10**

	Parameters	resistors, ammeters and voltmeters. 7.3 Series and parallel connection of PV modules, measuring of resulting current, voltage and power using ammeter, voltmeter and wattmeter. 7.4 Measuring the effect of cell temperature (at least three different temperatures) on IV and PV curve. 7.5 Measuring the effect of Insolation on IV and PV curve (at least three different Insolation values). 7.6 Demonstrating the shading impact on the output of PV modules.	
8	PV Technologies	8.1 Study monocrystalline and polycrystalline.	**5**
9	PV System, its Components and applications	9.1 Basic introduction to the PV systems and the components used in PV systems i.e solar panel, Battery, charge controller, Inverters. 9.2 Study the use of MPPT based charge controller on a real system. 9.3 Design pv system for residential, commercial and industrial purposes.	**10**
10	Operation and Maintenance of Photovoltaic System	10.1 Study operation and maintenance of solar panel 10.2 Study operation and maintenance of solar battery 10.3 Study operation and maintenance of solar charge controller 10.4 Study operation and maintenance of solar inverter.	**4**
	Total		**64**

6. Learning Facilitation Process

This course aims to blend both theoretical and practical aspects of knowledge and skills required in the subject. So, its facilitation process differs from the traditional method of delivery. The practical aspect is much more focused. So, methods and strategies that enable the practical skills in the students are much used in course of content facilitation. A facilitator encourages and assists students to learn for themselves engaging in different activities with practical tasks. To achieve the entire objectives from this syllabus, the teacher must use different techniques and process while teaching. In particular, the teacher can make use of the following methods and strategies for the learning facilitation:

- Discussion
- Demonstration
- Problem solving
- Presentation
- Case study
- Practical works
- Project works
- Field study
- Group works and pair works
- Exploration

7. Student Evaluation

Evaluation is an integral part of learning process. Both formative and summative modes of evaluation are emphasized. Formative evaluation will be conducted so as to provide regular feedback for students, teachers and parents/guardians about how student learning is. Class tests, unit tests, oral question-answer, home assignment etc, are some ways of formative evaluation.

There will be separate evaluation of theoretical and practical learning. Summative evaluation embraces theoretical examination, practical examination and evaluation of research work or innovative work.

(a) Internal Evaluation

Internal evaluation covers 50 Percent weight age. Internal evaluation consists of Practical Activities (Practical works and projects works) (35 Percent), (b) Marks from trimester examinations (10 Percent), and (c) Classroom participation (5 Percent). Practical work should be based on list of activities mentioned in this curriculum. Project works should be based on the mentioned lists or created by teachers. Mark distribution for internal evaluation (practical work and project work) will be as follows:

S.N.	Mani activities	Activities in detail	Percent
1	Participation	Participation in attendance, homework, classwork, project work, practical works etc.	5
2	Practical work	Conduction of practical work activities	15
		Record keeping of practical work activities	3
3	Project work	Conduction of project work activities	10
		Record keeping of project work activities	2
4	Viva	Viva of practical work and project work activities	5
6	Internal exam	First trimester 5 marks and Second trimester 5 marks	10
Total			50

Note:

(i) Practical examination will be conducted in the presence of internal and external supervisors. Evaluation of experiment will focus both the product of work and skills competencies of student in using apparatus.

(ii) Project work assessment is the internal assessment of reports and presentation of their project works either individually or group basis. In case of group presentation, every member of the group should submit a short reflection on the presented report in their own language. Records of project works must be attested by external supervisor.

(b) External Evaluation

There will be an external theoretical evaluation which covers 50% of the weight. The tool for external evaluation of theoretical learning will be a written examination. Questions for the external examination will be based on the specification grid developed

by Curriculum Development Centre. Examination question paper will be developed using various levels of revised Bloom's taxonomy including remembering level, understanding level, application level and higher ability (analyzing, evaluating, creating).

Specification Grid

Grade: 12 Subject: Renewable Energy System Time: 2 hrs.

Unit	Content	Credit hrs.	Knowledge and Understand			Application			Higher Ability			Total Question Number			Total Question	Marks Weight			Total Marks
			MCQ	Short	Long	MCQ	Short	Long	MCQ	Short	Long	MCQ	Short	Long		MCQ	Short	Long	
1	Renewable sources of Energy	3																	1
2	Introduction to micro hydro, its layout and civil construction works of MHP	6																	6
3	Electro-Mechanical Component of MHP Plant	15																	14
4	Protection System for MHP Plant	4	3	1	1	6	3	1	0	1	0	9	5	2	16	9	25	16	5
5	Operation and Maintenance of MHP Plant	4																	1
6	Introduction to Solar Energy, Solar Radiation, Orientation and Measurement	6																	2
7	Photovoltaic Cell and Performance Parameters	6																	6

8	PV Technologies	4																	**2**
9	PV System, its Components and applications	12																	**8**
10	Operation and Maintenance of Photovoltaic System	4																	**5**
	Total	64	3	1	1	6	3	1	0	1	0	9	5	2	16	9	25	16	50

Electrical CAD Based Design

Grades: 12 **Credit hrs: 4** **Working hrs: 128**

1. Introduction

Electrical Computer Aided Design (ECAD) software is used to create and modify both diagrams and layouts, including both 2D and 3D, in order to design, assess and document electronic Printed Circuit Boards (PCB). This course is designed to help students use these features in their works in electrical engineering field.

This curriculum comprises of the contents like: overview about drawing, basic drawing/drafting concept, introduction to the course and hardware, starting a new drawing/opening an existing drawing, drawing commands, modify commands, features, plotters and plotting the drawing, use of AutoCAD in electrical engineering drawings and practice. The course will impart the student not only the basic knowledge and skills in the various aspects of Electrical CAD Based design but also inculcate them service culture, self-discipline, teamwork, problem-solving, communication and presentation skills. It also provides opportunity for the learners who have deeper interest in the subject to delve into the more advanced contents so that the study of Electrical Engineering becomes enjoyable and satisfying to all.

The curriculum prepared in accordance with National Curriculum Framework is structured in such a way that it incorporates the level-wise competencies, grade-wise leaning outcomes, scope and sequence of contents, suggested practical/project activities, learning facilitation process and assessment strategies so as to enhance the learning on the subject systematically.

2. Competencies

On completion of the course, the students will have the following competencies:

1. Use popular CAD software programs (Autodesk Auto CAD) in different electrical installation works
2. Create basic Electrical drawings and provide necessary electrical connections

3. Explain the basic terminology, component and elements of different engineering structures and electrical components
4. Use the techniques of preparing drawings that are used for installation works.
5. Use of a Computer Aided Design and Documentation (CADD) system for the development of electrical services.

3. Grade-wise Learning Outcomes

S.N.	Content Area	Learning Outcomes
1	**Overview about drawing**	1.1 Introduce types of drawings. 1.2 List out the types of building structure. 1.3 Explain the terminology used in drawing, Components/elements of building. 1.4 Introduce and use engineering symbols and conventional signs. 1.5 Introduce to By-laws and codes.
2	**Basic drawing/drafting concept**	2.1 Introduce architectural drafting-lettering, dimensioning lines, title blocks, office standards. 2.2 Introduce drafting conventions and representation of different materials in section. 2.3 Introduce drafting and preparing foundation plans 2.4 Identify floor plans. 2.5 Identify exterior elevations and sections.
3	**Introduction to the course and hardware**	1.1 Introduce AutoCAD.
4	**starting a new drawing/opening an existing drawing**	7.2 Setup a drawing. 7.3 Open an existing drawing. 7.4 Manage Screen layout, pull-down menus, screen icons, command line and dialogue boxes, status bar toggles.

		7.5 Set preferences.
5	**Drawing commands**	8.10 Introduce co-ordinate input methods. 8.11 Identify point, lines, polyline, multiline, construction lines. 8.12 Identify circle, arc, ellipse, and donut. 8.13 Identify Polygon, Rectangle, Spline, solids etc. 8.14 Identify Hatching. 8.15 Identify Text /Dimensions.
6	**Modify Commands**	6.1 Introduce object selection. 6.2 Identify Erase, Trim, and Break. 6.3 Identify Copy, Mirror, Offset, and Array. 6.4 Identify Move, Rotate, Scale, Stretch. 6.5 Use Lengthen, Extend ,Chamfer, Fillet.
7	**Features:**	7.1 Use View tools. 7.2 Use Layers concept, match and change properties. 7.3 Use measure and divide. 7.4 Identify inquiry commands. 7.5 Work with Block, W-block and External References.
8	**Plotters and plotting the drawing**	8.1 Identify Plotters and plotting the drawing.
9	**Use of AUTOCAD In Electrical Engineering Drawings**	9.1 Explain the various electrical symbols used in Domestic and Industrial Installation and Power System as per NEC, IEC and BIS. 9.2 Introduce the contractor Control Circuits. 9.3 Introduce Earthing. 9.4 Introduce Line diagram of 11KV, 33KV , 66 KV and 132 KV substations. 9.5 Prepare a schematic diagram of Lighting and

		power circuits of conference room/Sports/stadium/ commercial malls/ theatre etc using CAD and drawing sheets.

4. Scope and Sequence of Contents

S.N.	Content Area	Elaboration of Contents	Hrs.
1.	**Overview about drawing**	1.1 Introduction to types of drawings 1.2 Architectural drawing, structural drawing, services drawing, detail drawings etc. 1.3 Types of building structure 1.4 Terminology used in drawing, Components/elements of building 1.5 Engineering symbols and conventional signs 1.6 Introduction to By-laws and codes	3
2.	**Basic drawing/drafting concept**	2.1 Architectural Drafting-Lettering, Dimensioning lines, Title blocks, Office standards 2.2 Drafting conventions, Representation of different materials in section, Graphic symbols 2.3 Drafting and preparing foundation plans 2.4 Floor plans 2.5 Exterior elevations 2.6 Sections	6
3	**Introduction to the course and hardware**	3.1 Overview of AutoCAD Release 3.2 Overview of a PC, peripherals e.g. printers and plotters, system settings and the Windows environment	3
4	**starting a new drawing/opening an existing**	4.1 Setting up a drawing starting from scratch, using a Wizard, using and creating a template file, drafting aids. 4.2 Opening an existing drawing	7

	drawing	4.3 Screen layout, pull-down menus, screen icons, command line and dialogue boxes, status bar toggles 4.4 Setting preferences (Setting Units and Scale, managing drawing area by using MVsetup and Limits.)	
5	**Drawing commands**	5.6 Co-ordinate input methods (directive, absolute, relative and polar) 5.7 Point, Lines, Polyline, Multiline ,Construction Lines 5.8 Circle, Arc, Ellipse, Donut 5.9 Polygon, Rectangle, Spline, , solids etc 5.10 Hatching 5.11 Text (multi-line & single line / true type fonts **5.12** Dimensions	10
6	**Modify commands**	6.1 Object selection 6.2 Erase, Trim, Break 6.3 Copy, Mirror, Offset, Array 6.4 Move, Rotate, Scale, Stretch 6.5 Lengthen, Extend 6.6 Chamfer, Fillet	8
7	**Features**	7.1 View tools, 7.2 Layers concept, match and change properties 7.3 measure and divide 7.4 inquiry commands 7.5 Working with Block, W-block and External References	8
8	**Plotters and plotting the drawing**	8.1 Plotters and plotting the drawing	3

9	**Use of AUTOCAD In Electrical Engineering Drawings**	9.1 Various Electrical Symbols used in Domestic and Industrial Installation and Power System as per NEC, IEC and BIS Contractor Control Circuits Design of circuit drawing of schematic diagram and power wiring diagram of following circuits, specification of contactors 9.1.1 DOL starting of 3-phase induction motor 9.1.2 3-phase induction motor getting supply from selected feeder 9.1.3 Forwarding/reversing of a 3-phase induction motor 9.1.4 Manually generated star delta starter for 3-phase induction motor 9.1.5 Automatic star delta starter for 3-phase Induction Motor 9.2 Earthing 9.2.1 Drawings of plate and pipe earthing 9.2.2 Earthing layout of distribution transformer 9.3.3 Substation earthing layout and earthing materials 9.4 Line diagram of 11KV, 33KV , 66 KV and 132 KV substations 9.5 Schematic Diagram of Lighting and power circuits of conference room/Sports stadium/ Commercial malls/ Theatre etc using CAD and drawing sheets	16
	Total		**64**

5. Suggested Practical and Project Works

Practical and project work is an integral part of technical and vocational subjects. They are carried out to consolidate the practical learning experiences. Some of the suggested

practical and project work activities of this subject are mentioned below. As these are the basic and fundamental practical and project works, the teacher can adapt or introduce more relevant to their context and students' needs.

S.N.	Grade 12		
	Scope	**Practical Activities**	**Hrs.**
1	**Overview about drawing**	1.1 Symbol and conventional sign	**3**
2	**Basic drawing/drafting concept**	2.1 Architecture drafting, foundation, floor plan, elevations, roof plan, site plan, location plan, schedule of door and window, electrical drawing, water supply and sanitary drawing	**5**
3	**Introduction to the course and hardware**	3.1 Setting up, create template file, drafting, opening, screen layout, setup dimension style	**2**
4	**starting a new drawing/opening an existing drawing**	4.1 Co-ordinate input, different drawing command	**3**
5	**Drawing commands**	5.1 Object selection, different modify command	**4**
6	**Modify commands**	6.1 Layer concept, measure, inquiry, and block	**3**
7	**Features:**	7.1 Uses plotter	**2**
8	**Plotters and plotting the drawing**	8.1 Use CAD to drawn different section, plan, elevation, etc.	**2**
9	**Use of AUTOCAD In Electrical Engineering Drawings**	9.1 Various Electrical Symbols used in Domestic and Industrial Installation and Power System as per NEC, IEC and BIS 1. 9.2 Contractor Control Circuits	**40**

		Design of circuit drawing of schematic diagram and power wiring diagram of following circuits, specification of contactors DOL starting of 3-phase induction motor 1. 3-phase induction motor getting supply from selected feeder 2. Forwarding/reversing of a 3-phase induction motor 3. Manually generated star delta starter for 3-phase induction motor 4. Automatic star delta starter for 3-phase Induction Motor 9.3 Earthing 9.4 Drawings of plate and pipe earthing 9.5 Earthing layout of distribution transformer 9.6 Substation earthing layout and earthing materials 9.7 Line diagram of 11KV, 33KV , 66 KV and 132 KV substations 9.8 Schematic Diagram of Lighting and power circuits of conference room/Sports stadium/ Commercial malls/ Theatre etc using CAD and drawing sheets	
	Total		**64**

6. Learning Facilitation Method and Process

Learning facilitation process is the crux of the teaching and learning activity. One topic can be facilitated through two or more than two methods or processes. The degree of usage will be based on the nature of the content to be facilitated. However, a teacher should focus on methods and techniques that are more students centered and appropriate to facilitate the content. The following facilitation methods, techniques and strategies will be applied while conducting the teaching learning process:

- Demonstration
- Presentation
- Case study
- Practical works
- Project works
- Problem solving
- Field study
- Discussion
- Group works and pair works
- Questionnaire
- Exploration

7. Student Evaluation

Evaluation is an integral part of learning process. Both formative and summative modes of evaluation are emphasized. Formative evaluation will be conducted so as to provide regular feedback for students, teachers and parents/guardians about how student learning is. Class tests, unit tests, oral question-answer, home assignment etc, are some ways of formative evaluation.

There will be separate evaluation of theoretical and practical learning. Summative evaluation embraces theoretical examination, practical examination and evaluation of research work or innovative work.

(a) Internal Evaluation

Internal evaluation covers 50 Percent weight age. Internal evaluation consists of Practical Activities (Practical works and projects works) (35 Percent), (b) Marks from trimester examinations (10 Percent), and (c) Classroom participation (5 Percent). Practical work should be based on list of activities mentioned in this curriculum. Project works should be based on the mentioned lists or created by teachers. Mark distribution for internal evaluation (practical work and project work) will be as follows:

S.N.	Mani activities	Activities in detail	Percent

1	Participation	Participation in attendance, homework, classwork, project work, practical works etc.	5
2	Practical work	Conduction of practical work activities	15
		Record keeping of practical work activities	3
3	Project work	Conduction of project work activities	10
		Record keeping of project work activities	2
4	Viva	Viva of practical work and project work activities	5
6	Internal exam	First trimester 5 marks and Second trimester 5 marks	10
Total			50

Note:

(i) Practical examination will be conducted in the presence of internal and external supervisors. Evaluation of experiment will focus both the product of work and skills competencies of student in using apparatus.

(ii) Project work assessment is the internal assessment of reports and presentation of their project works either individually or group basis. In case of group presentation, every member of the group should submit a short reflection on the presented report in their own language. Records of project works must be attested by external supervisor.

(b) External Evaluation

Theoretical evaluation covers 50 marks. The tool for external evaluation of theoretical learning will be a written examination. Questions for the external examination will be based on the specification grid developed by Curriculum Development Centre. Examination question paper will be developed using various levels of revised Bloom's taxonomy including remembering level, understanding level, application level and higher ability (analyzing, evaluating, creating).

Specification Grid, 2078

Grade: 12 Subject: Electrical CAD Based Design Time: 2 hrs.

Unit	Content	Credit hrs.	Knowledge and Understand			Application			Higher Ability			Total Question Number			Total Question	Marks Weight			Total Marks
			MCQ	Short	Long	MCQ	Short	Long	MCQ	Short	Long	MCQ	Short	Long		MCQ	Short	Long	
1	Overview about drawing	3	8	2		1	2	1	0	1	1	9	5	2	8	2		1	1
2	Overview about drawing	6																	5
3	Introduction to the course and hardware	3																	1
4	starting a new drawing/opening an existing drawing	7																	6
5	Drawing commands	10																	6
6	Modify commands	8																	2
7	Features	8																	14
8	Plotters and plotting the drawing	3																	1

9	Use of AUTOCAD In Electrical Engineering Drawings	16																	**14**
	Total	64	8	2		1	2	1	0	1	1	9	5	2	16	9	25	16	50

Power Transmission and Distribution

Grades: 12 **Credit hrs: 4** **Working hrs: 128**

1. Introduction

Power transmission is the large scale movement of electricity at high voltage levels from a power plant to a substation. whereas power distribution is the conversion of high voltage electricity at substations to lower voltages that can be distributed and used by private, public, and industrial customers. This course on power transmission and distribution is developed so as to help students impart the basic knowledge and skills on the subject.

This curriculum comprises of the contents like: an introduction to electrical supply system, high voltage DC transmission, transmission line components and performance, cables, distribution and voltage control. The course will impart the student not only the basic knowledge and skills in the various aspects of power transmission and distribution but also inculcate them service culture, teamwork, problem-solving, communication and presentation skills.

The curriculum prepared in accordance with National Curriculum Framework is structured in such a way that it incorporates the level-wise competencies, grade-wise leaning outcomes, scope and sequence of contents, suggested practical/project activities, learning facilitation process and assessment strategies so as to enhance the learning on the subject systematically.

2. Competencies

The students will have the following competencies:

1. Explain different components used in the transmission and distribution of power system
2. Describe the details of cable construction
3. Understand the existing distribution system practices
4. Realize the importance of voltage control.

3. Grade-wise Learning Outcomes

S.N.	Content Area	Learning Outcomes
1	**Introduction to electrical supply system**	1.1 Introduce electrical supply system. 1.2 Compare between AC and DC systems for transmission and distribution. 1.3 List out the systems of transmission of electrical power. 1.4 Compare between overhead and underground systems.
2	**High voltage DC Transmission**	2.1 Select of voltage for H.T and L.T lines. 2.1.1 Select voltage for transmission line using empirical formula. 2.2 Introduce mechanical terms of overhead lines.
3	**Transmission line components and performance**	3.1 Introduce the transmission line components. 3.2 Introduce line resistance. 3.3 Provide concept of skin effect. 3.4 Introduce line inductance. 3.5 Give concept of bundled conductors. 3.6 Introduce the proximity effect. 3.7 Find the capacitance of transmission line. 3.8 Introduce the transposition of three phase lines. 3.9 Introduce Corona.
4	**Cables**	4.1Introduce cables. 4.2 Design of cables. 4.3 Introduce cable conductors. 4.4 Identify insulating materials for cables. 4.5 Classify cables. 4.6 Compare O.H. Lines and underground cables. 4.7 Select cables.
5	**Distribution**	5.1 Introduce AC and DC distribution. 5.2Classify Distribution systems. 5.3 Introduce Radial, Ring and interconnected system of

		Distribution. 5.4 Determine size of conductors. 5.5 Introduce Losses in distribution system.
6	**Voltage control**	6.1 Describe the concept of necessity of voltage control. 6.2 List out the methods of voltage control.

4. Scope and Sequence of Contents

S.N.	Content Area	Elaboration of Contents	Hrs.
1	Introduction	1.1 Electrical supply system. 1.2 Comparison between AC and DC systems for transmission and distribution 1.3 Various systems of transmission of electrical power 1.4 Comparison between overhead and underground systems	**6**
2	Transmission Line Components	2.1 Selection of voltage for H.T and L.T lines, 2.1.1Economical voltage selection for transmission line using empirical formula 2.2 Mechanical terms of overhead lines 2.2.1 Main components of overhead lines 2.2.2Types of line supports 2.2.3Types of insulators 2.2.4Types of conductor material and sizes from standard tables 2.2.5 Cross Arms 2.2.6 Guys and stays 2.2.7 Conductor configuration, spacing and clearances 2.2.8 Span length 2.2.9 Selection of insulators, conductors, earth wire and their accessories 2.2.10Dampers and spacers	12

		2.2.11 Right of way(ROW)	
3	**Transmission line Parameters**	3.1 Introduction 3.2 Line resistance 3.3 Skin effect 3.4 Line inductance 3.5 Bundled conductors 3.6 Proximity effect 3.7 Capacitance of transmission line 3.8 Transposition of three phase lines 3.9 Corona 3.9.1 Factors affecting corona 3.9.2 Advantages and disadvantages of corona 3.9.3 Methods of reducing corona effects	**14**
4	**Cables**	4.1Introduction to cables 4.2 General construction 4.3 Cable conductors 4.4 Insulating materials for cables 4.5 Classification of cables 4.6 Comparison between O.H. Lines and underground cables 4.7 Selection of cables	**8**
5	**Distribution System**	5.1 Introduction: AC and DC distribution 5.2Classification of Distribution systems, 5.2.1Primary distribution 5.2.2Secondary distribution :Feeders, distribution and service mains 5.3 Radial, Ring and interconnected system of Distribution, 5.4 Determination of size of conductors 5.5 Losses in distribution system	**14**
6	**Voltage**	6.1 Necessity of voltage control, voltage fluctuation	**10**

	control	and problems 6.2 Methods of voltage control 6.2.1 Excitation control of alternator 6.2.2 Tap changing transformer 6.2.3 Shunt compensation-static VAR 6.2.4 Synchronous condenser	
	Total		**64**

5. Suggested Practical and Project Works

The practical and project works are integral parts of reinforcing the students' learning. So the new curriculum provisions the practical and projects works as a part of curriculum. Some of the sample practical and project works are suggested herewith. However, a teacher can adapt them or use similar other project works as per their students need and specific context.

S.N.	**Grade 12**		
	Content Area	**Practical Activities**	**Hrs.**
1	**Introduction**	1. Understand the electrical supply system 2. Group discussion on difference between transmission and distribution system 3. Case study on standard voltages of transmission and distribution system of Nepal. 4. Debate of AC vs DC transmission system (AC – DC war between Nikola Tesla and Thomas Alba Edison)	**8**
2	**Transmission Line Components**	1. Observation of different components of transmission lines. 2. Compare different types of steel towers/Pylons used for different voltage level. 3. Compare different kinds of conductors used in overhead lines	**14**

		4.Visit nearest transmission site of NEA and write a report on existing system	
3	**Transmission line Parameters**	1.Prepare a report on corona and its effect in transmission system.	**4**
4	**Cables**	1. Study of cable construction 2. Study of different kinds of cables.	**4**
5	**Distribution System**	1 Visit nearest distribution site of NEA and write a report on existing system	**20**
6	**Voltage control**	1 visit nearest distribution site of NEA and write a report on used voltage regulation in it	**14**
	Total		**64**

6. Learning Facilitation Process

Learning facilitation process is determined according to the content to be dealt in the subject. It's also an art of teacher. The teacher should utilize such teaching methods and techniques that are appropriate to the contents and needs of the students. In facilitating the course, various approaches, methods and techniques are used. To be particular, the following major methods and strategies are used in this subject:

- Discussion/ Debate
- Problem solving
- Audio/Visual
- Demonstration
- Presentation
- Case study
- Practical works
- Project works
- Field study
- Group works and pair works
- Questionnaire
- Exploration

7. Student Evaluation

Evaluation is an integral part of learning process. Both formative and summative modes of evaluation are emphasized. Formative evaluation will be conducted so as to provide regular feedback for students, teachers and parents/guardians about how student learning is. Class tests, unit tests, oral question-answer, home assignment etc, are some ways of formative evaluation.

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(b) External Evaluation

On this subject, there will be an external theoretical evaluation which covers 50% of marks. The tool for external evaluation of theoretical learning will be a written examination. Questions for the external examination will be based on the specification grid developed by Curriculum Development Centre. Examination question paper will be developed using various levels of revised Bloom's taxonomy including remembering level, understanding level, application level and higher ability (analyzing, evaluating, creating).

Specification Grid,

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1	Introduction	6																	6
2	Transmission Line components	12																	10
3	Transmission line Parameters	14																	8
4	Cables	8																	6
5	Distribution System	14																	14
6	Voltage control	10	6	2	1	3	2	1	0	1	0	9	5	2	16	9	25	16	6
	Total	64	6	2	1	3	2	1	0	1	0	9	5	2	16	9	25	16	50