Logic & Scientific Method

Syllabus

Grades 12 and 13

(To be implemented from 2017)

Department of Social Sciences

National Institute of Education

Maharagama

Sri Lanka

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Content

Preface

This syllabus had been prepared for the G.C.E Advanced Level Examination subject stream. This syllabus will be executed from 2017 related to new educational refurbishments. This curriculum is scheduled for three dimensional representatives who inculcate Advanced Level Logic and Scientific method as well as students by analytically acquiring ideas, attitudes and suggestions of them.

The subject content will be developed within 18 competencies and competency levels. Specific Teacher Guides for grade 12 and 13 including expected learning and learning outcomes will be introduced in near future. (theoretical and practical aspects of logical thinking and scientific thinking)

We constrain to contribute for generating good citizens with logical knowledge and prospering their lives by demystifying this particular syllabus.

Introduction

The new syllabus of Logic and Scientific Method will be started from grade 12 in 2017. This syllabus is convincingly prepared relevant to national procedures and encountered potentials.

The logic is depicted as a subfield of eastern and western philosophy and also appeared as an important component for facilitating knowledge in many civilizations. Incomparable and uncountable results could be obtained by elucidating this subject accordingly. The ability for generating accurate, systematic and logical conclusions is one of the unique practises could be reached among this subject. The person, who is involved in reasoning, diligently contemplates errors which had occurred in logical thinking rather than the others. Therefore the utility of logic is incomparable for any knowledge based subject.

Obviously reasoning is not extraneous of human thoughts. Therefore nothing could exist without reasoning or inference. The truth and accuracy will have escaped whether it is unsystematic. The logic becomes prominent of applied knowledge experimentations until recently it was concentrated on inculcating veritable of nature. This subject was rapidly developed in the following nineteenth century. It has recently popularised as a technological subject stream. It is also manifested in computer schools by constructing technology and artificial intelligence. The logic is the centre in all sciences because an intimate relationship was constructed with subjects which are sophistically contributed for academic development.

The reason which had intertwined with regular usage is one of our inheritances. An academic exposure would emphasise when it inculcates formally and systematically. The scientific method is enunciated as the science of logic and it correlates with logical reasoning. The knowledge of logic is helpful for determining scientific knowledge through deductive and inductive basements and to question the redefined knowledge through logical thinking patterns. It is conspicuous that the previous syllabus had also accomplished for determining above circumstances. The new syllabus is a proper integration of all components. The ultimate objective of this syllabus is to provide an accurate knowledge in fundamental and specific utility of logic and scientific method.

The first approach of this syllabus is to demystify the formal accuracy of reasoning and term calculus, proposition calculus and predicate calculus. Truth tree method, logic gates and Indian logic were also explicated in this curriculum. "Karnaugh Map" will be introduced as a neo approach for this process. The new syllabus is also consisted with fallacies, logical formats of law related to critical thinking and logical features of evaluative sciences. The second approach of this syllabus is on scientific method. The components based on modern science will be experimented and elaborated in this aspect. Apart from that, this curriculum aims to generate an academic discipline for referencing the correlation between science and society, the socio ethical and environmental crisis faced by modern globalised society in a particular scientific basement.

This syllabus will be an appropriate element for empowering student centred learning process by the original features derived from this subject field. And also the edification will have provided to become a knowledge originator.

National Goals

(i)   Nation building and the establishment of a Sri Lankan identity through the promotion of national cohesion, national integrity, national unity, harmony, and peace, and recognizing cultural diversity in Sri Lanka's plural society within a concept of respect for human dignity.

(ii) Recognizing and conserving the best elements of the nation's heritage while responding to the challenges of a changing world.

(iii) Creating and supporting an environment imbued with the norms of social justice and a democratic way of life that promotes respect for human rights, awareness of duties and obligations, and a deep and abiding concern for one another.

(iv) Promoting the mental and physical well- being of individuals and a sustainable life style based on respect for human values.

(v)   Developing creativity, initiative, critical thinking, responsibility, accountability and other positive elements of a well- integrated and balanced personality.

(vi) Human resource development by educating for productive work that enhances the quality of life of the individual and the nation and contributes to the economic development of Sri Lanka.

(vii) Preparing individuals to adapt to and manage change, and to develop capacity to cope with complex and unforeseen situations in a rapidly changing world.

(viii) Fostering attitudes and skills that will contribute to securing an honorable place in the international community, based on justice, equality and mutual respect. (Adapted from National Education Commission Report -2003)

Basic Competencies

The following basic competencies developed through education will contribute to achieve the above national goals.

(i)   Competencies in communication

Competencies in communication are based on four subsets: Literacy, Numeracy, Graphics and IT proficiency.

Literacy   : Listen attentively, speak clearly, read for meaning, write accurately and lucidly and communicate ideas effectively.

Numeracy   : Use numbers for goods/items, space and time, use of. numerals sysrtematically to count & measure.

Graphics   : Make sense of line and form, express and record details, instructions and ideas with line, form and colour.

IT proficiency   : Computer literacy and the use of information and communication technologies (ICT) in learning, in the work environment and in personal life.

(ii)   Competencies relating to personality development

- Generic skills such as creativity, divergent thinking, initiative, decision making, problem solving, critical and analytical thinking, team work, inter – personal relations, discovering and exploring ;

- Values such as integrity, tolerance and respect for human dignity;

- Emotional intelligence.

(iii)   Competencies relating to the environment

These competencies relate to the social, biological and physical environment.

Social Environment   -   Awareness of the national heritage, sensitivity and skills linked to being members of a plural society, concern for distributive justice, social relationships, personal conduct, general and legal conventions, rights, responsibilities, duties and obligations.

Biological Environment -   Awareness, sensitivity and skills linked to the living world, people and the ecosystem, the trees, forests, seas, water, air and life – plant, animal and human life.

Physical Environment - Awareness, sensitivity and skills linked to space, energy, fuels, matter, materials and their links with human life, food, clothing, shelter, health, comfort, respiration, sleep, relaxation, rest, wastes and excretion.

Included here are skills in using tools and technologies for learning, working and living.

(iv)   Competencies relating to preparation for the World of Work
Employment related skills to maximize their potential and to enhance their capacity.

- To contribute to economic development.
- To discover their vocational interests and aptitudes,
- To choose a job that suits their abilities, and
- To engage in a rewarding and sustainable occupation.

(v)   Competencies relating to religion and ethics

Assimilating and internalizing values, so that individuals may function in a manner consistent with the ethical, moral and religious modes of conduct in everyday life, selecting that which is most appropriate values.

(vi)   Competencies in play and the use of leisure

Pleasure, joy, emotions and such human experiences as expressed through aesthetics, literature, play, sports and athletics, leisure pursuits and other creative modes of living.

(vii)   Competencies relating to ' learning to learn'

Empowering individuals to learn independently and to be sensitive and successful in responding and managing change through a transformative process, in a rapidly changing, complex and interdependent world.
(Adopted from National Education Commission Report - 2003)

Aims of teaching Logic and Scientific method

Students will acquire following capabilities after completing this curriculum successfully. They are;

- To work towards for perfecting intelligent abilities.

- Contemplation of fallacies occurred in logical thinking.

- Taking accurate approaches for logical judgements.

- Understand laws of the nature

- Comprehend "how to think?" and avoid "what to think?"

- Generate logical thinking for investigating, analysing, criticising and creating a perfect thing.

- Obtain the edification for revealing points and to refer them.

- Facilitate to clear, unique mind and thinking for empowering comprehensive capability to infer unknown things from well-known things.

- Understand that the logical rules are also entitled as well as grammatical rules for determining meaningful statements.

- Guide for creating and solving problems relevant to a logical approach.

- Determine that the scientific and technological knowledge is based on a specific logical foundation.

- Assign a logical foundation for legal and ethical judgements in a realistic approach.

Relationship between National Objectives and Subject Objectives

National Objectives	Subject Objectives	Competency Level
i Nation building and the establishment of Sri Lankan identity through the promotion of national cohesion, national integrity, national unity, harmony and peace and recognizing cultural diversity in Sri Lanka's plural society within a concept of respect for human dignity.		
ii Recognizing and conserving the best elements of the nation's heritage while responding to the challenges of a changing world.		
iii Creating and supporting an environment imbued with the norms of social justice and a democratic way of life that promotes respect for human rights, awareness of duties and obligations, and a deep and abiding concern for one another.	• Understand laws of the nature	9.1 Different fields of Law. 9.2 Analyses the nature of evidence in legal field. 9.3 Deductive and Inductive process of reasonning in the field of Law
iv Promoting the mental and physical well-being of individuals and a sustainable life style based on respect for human values.		
v Developing creativity, initiative, critical thinking, responsibility, accountability and other positive elements of a well-integrated and balanced personality.	• To work towards for perfecting intelligent abilities. • Taking accurate approaches for logical judgements.	6.1 Symbolizes universal, Particular and Singular sentences by means of symbols such as Name letters, Predicate lettres, variables etc in terms of Predicate Calculus

National Objectives	Subject Objectives	Competency Level
	• Contemplation of fallacies occurred in logical thinking. • Generate logical thinking for investigating, analysing, criticising and creating a perfect thing. • Understand that the logical rules are also entitled as well as grammatical rules for determining meaningful statements. • Guide for creating and solving problems relevant to a logical approach. • Assign a logical foundation for legal and ethical judgements in a realistic approach.	6.2 Identifies the bound and free variales and applies propper substitutions 6.3 Derivation of arguments and proof of theorems. 6.4 Tree method in Propositional Calculus. 8.1 Fallacies in formal arguments. 8.2 Tests the nature of non- formal fallacies in arguments. 8.3 The difference between factual statements and evalative statements. 12.1 Describes the nature of scientific generalizations. 12.2 Analyses the featurs of different scientific tests 13.1 Defines events of a probable pretest. 13.2 Explicate probability in different approaches 13.3 Utilize structures of probability for solving problems. 14.1 Applies meaningfully measurement in science 15.1 Introduces the nature of statistics. 15.2 Monitoring samples for collecting data and information. 15.3 Utilizes the eligible central tendencies for arriving accurate desicion of a statistical distribution. . 15.4 Enunciate the expansion of a statistical distribution by the means of dispersion measures. 15.5 Correlational measures 15.6 Explain the errors of statistical usage.

National Objectives	Subject Objectives	Competency Level
vi Human resource development by educating for productive work that enhances the quality of life of the individual and the nation and contributes to the economic development of Sri Lanka.		
vii Preparing individuals to adopt to and manage change, and to develop capacity to cope with complex and unforeseen situations in a rapidly changing world.	• Obtain the edification for revealing points and to refer them. • Determine that the scientific and technological knowledge is based on a specific logical foundation. • Taking accurate approaches for logical judgements. • Determine that the scientific and technological knowledge is based on a specific logical foundation. • Facilitate to clear, unique mind and thinking for empowering comprehensive capability to infer unknown things from well-known things.	1.1 Explains the different definitions of Logic 1.2 Explains the relation between Logic and other sciences 1.3 Analyses the Practical value of Logic 2.1 Analyses the ways of building logical connections of terms. 2.3 Uses propositions, identifying their different categories. 3.1 1Illustrates how immediate inferences could be practically applied in daily life 3.2 Constructs figures for arguments in traditional Logic. 4.1 Basic concepts explicated in class logic (set theory) 4.2 Demonstrate propositions and arguments by Venn Diagrams. 5.1 Translates verbal sentences into symbolic statements and symbolic formulae into language. 5.2 Determines the validity of arguments by means of direct amd indirect truth tables. 5.3 Enunciate the validity of an argument by truth tables. 5.4 Applies the truth tree method to detemine the validity of arguments

National Objectives	Subject Objectives	Competency Level
		5.5 Proves the validity of an argument by means of truth tree method
		5.6 Proves the validity of arguments and theorems by means of approved rules of derivational methods.
		10.1 Defines the concept of "science"
		10.2 Applies the nature of science and its divisions in formulating scientific methodology
		11.1 Analyses the difference between the function of the scentist and methodologist.
		11.2 The difference between Inductive and Deductive methodologies.
		11.3 Analyses critically the views of Relative Methodology and Scientific Research Programme.
		7.1 Constructs Logic Gates for symbolic formiulae.
		7.2 Uses carno maps to make complex circuits simple.
		16.1 Exhibits past knowledge in modern science
		16.2 Analyses modern science and contemporary views and theories.
		17.1 Analyse the differcnce between social science and Natural science
		17.2 Applies social scientific research methods.
		17.3 The substaintiality of the social sciences
		18.1 Observes the relation between science and technology

National Objectives	Subject Objectives	Competency Level
		18.2 Identifies that the development of science and technology could be used for the advantage and disadvantage of individual and society.
viii Fostering attitudes and skills that will contribute to securing an honourable place in the international community, based on justice, equality and mutual respect.		

Proposed Plan to Divide the Syllabus according to School Academic Terms

Grade	Term	Competency Level	Periods
12	I	1.1 , 1.2 , 1.3, 2.1 , 2.2 , 2.3 , 3.1 , 3.2 , 10.1	100
	II	4.1, 4.2, 5.1 , 10.2 , 11.1, 11.2, 11.3	100
	III	5.2 , 5.3, 5.4, 5.5 , 5.6, 12.1	100
13	I	6.1 , 6.2 , 6.3, 6.4, 7.1, 7.2, 12.2	100
	II	13.1, 13.2, 13.3, 14.1, 15.1, 15.2, 15.3, 15.4, 15.5, 15.6, 17.1, 17.2, 17.3	100
	III	8.1 , 8.2 , 8.3, 9.1, 9.2, 9.3, 16.1, 16.2, 18.1, 18.2	100

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods

1. Exhibits the ability of reaching a conclusion, of the un known with the help of known facts.	1.1 Explains the different definitions of Logic	• The nature and subject matter of Logic
		• Difinitions of Logic
		• History of Logic
		   • Western
		   • Eastern
			• States the nature of Subject matter by means of logical definitions.
			• Describes the historical devel opment of Logic through the ages.
			• Compares the manner in which the development of Western and Eastern Logic took place
				10

	1.2 Explains the relation between Logic and other sciences	• Logic - Philosophy • Logic - Language • Logic - Pure Mathematics • Logic - Psychology • Logic - Law	• Analyses the relation between Logic and other Sciences • Evaluates the practical application of Logic to other Sciences	06
	1.3 Analyses the Practical value of Logic	• It as the basis of systematizing Knowledge. • logical thinking as a component of problemsolving • logic as a personality measurement • logic as a specific basement / foundation for the modern technology.	• Assess how Logic is useful in daily life • Analyses how logical thinking could be applied in research • Evaluates computer activities on logical thinking	04

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods

2. Indicates by means of different method of analysis, correct logical meaning	2.1 Analyses the ways of building logical connections of terms.	• The features of systematic Language
		  - Charactertics of logic Language
		  - Truth and validity
		  - Introdiuces in a simple manner, terms and propositions.
		• Classification of terms.
		• Based on connotation and denotation
		  • Concrete and Abstract terms
		  • Singular terms, General terms, Collective terms and theirdivisions
		  • Positive terms and Negative terms
		  • Contradictory and contrary terms
		• Absolute terms and Relative terms
		• Privative terms
		• Logical relations of relative terms
		  • Symmetrical Relations
		  • Asymmetrical Relations
		  • Transitive Relations
		  • Non -Transitive Relations
			• States the correct use of language
			• Distinguishes truth and validity
			• Analyses the Logical meanings of terms.
			• Categorises the logical relation between terms
			• Assesses the importance of use of terms in arguments.
				10

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
	2.2 Application of Laws of Thought	• Laws of Thought • The general features of laws - The Law of Identitiy - The Law of Non - Contradiction - The Law of Excluded Middle - The Law of Double Negation - The Law of Sufficient Reason	• Lists the different laws of thought • Identifies the difference be tween laws of thought and Sci entific laws • Differentiates between the law of sufficient reason and traditional • Determines the importance of these fundamental laws in rela tion to valid thinking	05
	2.3 Uses propositions, identifying their different categories.	• Propositions • Sentence and Propsition (Features of a declarative statement) • Different Propositions • Simple - Complex • Analytic - Synthetic Propositions • Categorrical, Hypothetical, Disjunctive Propositions • On the basis of quantity and quality (A,E,I,O) propositions and their distribution of terms • Singular, Particular,Universal, Propositions	• Identifies the difference between a sentence and proposition • Exhibits the ability of categorizing propositions. • Applies the distribution of terms in categorical propositions • Recasts sentences into categorical form • Evaluates the logical nature of different statements.	15

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods

3.Inference of conclusions in traditional logic by means of immediate and mediate inferences	3.1 Illustrates how immediate inferences could be practically applied in daily life	• Inferences in Traditional Logic
		• Immediate inference
		• opposition of Propositions (Contrary ,sub - Contrary, sub - altern, contradictory)
		• The validity of inference based on the square of opposition of propositions
		  - Eduction
		  - Conversion
		  - Obversion
		  - Contrapositive
		  - Obverted Converse
		  - Obverted Contrapositive
		  - Inversion
		  - Obverted Inversion
			• List the main forms of inference
			• Identifies a pair of propositions to be, true, false or indeterminable
			• Distinguishes between opposition of propositions and eduction
			• Analayses the fallacies that occur in general discourse in relation to the rules of eduction.
			• Evaluates how diferent inferences help to construct valid arguuctiments
			
			.
				2 5

	3.2 Constructs figures for arguments in traditional Logic.	• Mediate Inference (syllogism) • Features of syllogisms • Arrives at conclusions by means of premises • Derives a knowlesge of the three types of terms in syllogisms • Pure syllogisms (Categorical, Hypothetical, Disjunctive) • Mixed syllogisms (Hypothetical, Disjunctive, Dilemma) • Main rules of syllogism and validity	• Understands the knowledge derived from logical inference • Describes different forms of inferences • States the difference between form and content of an argument. • Recasts verbal statements into strict syllogistic form	1 0 .

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
		• Sub - rules of syllogisms • The relation between main rules and sub - rules of syllogisms • figures of syllogisms and valid moods • Enthymeme and sorites • Limitations and weaknesses of syllogistic reasoning • comparative study on Aristotelean Logic and Indian Logic (discusses the features of Indian logic)	• Determines the validity of arguments by means of rules of syllogism • Determines by means of syllogistic rules the ommitted proposition of an enthymeme.	

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
4. Studies class Logic and attaining into logical implications	4.1 Basic concepts explicated in class logic (set theory)	• Introduction to set theory • Euler's diagrams and Venn's diagrams with a modern analysis. • Introduces the main concepts of set theory(Universal set, set, set complement, Null set, sub sets, infinit e set, equal set, Union, Interstction)	• Understands the nature of set theory • Explains the concepts of set theory in relation to mathematical concepts	10
	4.2 Demonstrate propositions and arguments by Venn Diagrams.	• Different types of propositions - Universal propositions - Particular propositions - Singular propositions - Exclusive, Exceptive, Existential propositions • To symbolize verbal arguments in terms of classes and represent them by means of Venn's diagrams. • To determine the validity of arguments by menas of symbolizations and Venn's diagrams.	• To represent different propositions by Venn's diagrams. • Translate symbolic formulae into verbal statements. • Determines the validity of arguments in terms of venn's diagrammes (sets)	15

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
5. Determines the validity of arguments by identifying the formal aspect of deductive systems	5.1 Translates verbal sentences into symbolic statements and symbolic formulae into language.	• Nature and objective of Modern Logic • Introduces Propositional calculus • Deductive systems • Simple sentences. • Well formed formulae • Translate linguistic statements (sentences into symbolic formulae.	• Obtains the correct knowledge of the basic concepts of Propositional Calculus. • Identifies the logical nature of simple and complex sentences. • Constructs well - formed formulae •Transaltes verbal statements into symbolic formulae. • Exercises to practise how to translate symbolic formulae into vebal sentences	20
	5.2 Determines the validity of ar guments by means of direct amd indirect truth tables.	• Truth table method in Propositional Calculus • Providing truth values for variables. • The basis of truth values (Negation, Implication, Conjunction, Disjunction, strong Disjunction, Biconditional) • Determine tautologies, contra dictory and contingency. • To determine that a pair of symbolic formulae is logically equal, contradictory, or neither equal nor contradictory	• Understands the truth values in relation to the meanings of constants • Determines the validity of arguments by the direct and indirect methods of truth tables • Acquires an ability to compare different symbolic formulae • Lists the symbolic formulae that are equal and contradictory • Determines by means of truth tables, tautology, equal and contradictory symbolic	20

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
		• Constructs equal/ contradictory for mulae • Determines the truth value of a given symbolic formulae without the use of truth tables	formulae • Constructs symboilc formulae that are equal or contradictory to given symbolic formulae • Compares the nature of different symbolic formulae • Predicate the verification of symbolic statement by the veri fication of a formulae/ character.	

	5.3 Enunciate the validity of an argument by truth tables.	•Determine the validity of an argument
		   - Direct truth tables
		   - indirect truth tables
			•Recognise various practises
			•Establish the validity of an argu-ment through direct and indirect truth tables.
				15

	5.4 Applies the truth tree method to determine the validity of arguments	• Introduction to truth tree method • The general rules of truth truth tree method. • Indicates by the truth tree method the structure of symbolic formulae. • Close and open trees. • Consistency and inconsistency of a system.	• Determines the consistency - inconsistency within a system. • Identifies the contribution of the truth three method to determine the validity of arguments. • Discusses the rules of truth tree method. • Apples the rules of truth tree	10

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
		• Determines by the truth tree method whether asymbolic formulae are a tautology, contradictory or contingency • Determines by truth tree method whether the conclusions of pairs of symbolic formulae are equal, contradictory or neither equal or contradictory	method to determine the validity of arguments. • Analyses different logical formulae by the truth tree method. • Evaluates the use of truth tree method in propsitional calcilus	
	5.5 Proves the validity of an argument by means of truth tree method	• Determine the validity of an argument by the truth tree method • proving theoroms by truth tree method	• Insert rules of truth tree method for determining the validity of an argument • Prove theorems by truth tree method • evaluate the truth tree method with in proposition calculus.	10
	5.6 Proves the validity of arguments and theorems by means of approved rules of derivational methods.	• Derivational method in Propositional calculus. • Approved rules. • Derivational methods. (Direct Indirect, Conditional) • Application of sub - derivations. • Introdues theorems and their proof	• Identdenifies the approved rules of derivation • Derives the conclusions of an argument by means of its premises and ten approved rules of derivation. • Identifies theorems and proves them • Evaluate the usage of theoroms	25

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
10. Formulates scientific methods in terms of critcal thinking in relation to the History of science	10.1 Defines the concept of "science"	• Introduces science. • The difference between Science and non - Science in relation to Popper's demarcation principle	• States the historical development of science in relation to different periods. • Gathers information regarding different analyses of science.	10

	10.2 Applies the nature of science and its divisions in formulating scientific methodology	• Science, is knowledge based on reason or/and sense perception.
		• Divisions of science
		  - Non - Empirical Sciences - Empirical Sciences.
		  - Natural Sciences - Social Sciences
		  - Pure Sciences - Applied Science.
		  - Descriptive Sciences - Evaluative Sciences.
		(Problems that emerged in relation to these divisions)
			• Categorizes sciences
			• Describes the basic features of different sciences
			• Describes the mutual relation between sciences
			• Evaluate the integration of sciences.
				10

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
11. Application of different scientific methods in practical situation	11.1 Analyses the difference between the function of the scentist and methodologist.	• The basic features of scientific methodology • The difference between the function of the scientist and methodologist	• Understands the basic features of Scientific methodology • Demonstartes scientific methodology in relation research.	05
	11.2 The difference between Inductive and Deductive methodologies.	• The schools of scientific methodology • Inductive Methodology • Deductive verficational Method ology • Deductive falsificational Method ology	• Identifies traditional methodologies and describes contemporary criticisms leveled agaisnt them. • Examines deductive and inductive methodology. • Examines the difference between deductive and inductive methodologies.	20
	11.3 Analyses critically the views of Relative Methodology and Scientific Research Programme.	• The view of Relative Methodology. (Thomas Kuhn's and Paul Feyerabend's) • Features of a paradigm and the inconsistency and incommensurability in successive theories. • Scientific Research Programme (Imre Lakatos) • A descriptive introduction and criticisms levelled against the above mentioned methodologis	• Examines different views of Relative methodology • Concludes that there is no definite methodology in scientific discovery. • Describes the features of Lakatos' scientific research programme in relation to a scientific theory.	20

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
12. Applies methods to test scientific hypotheses	12.1 Describes the nature of scientific generalizations.	• Scientific hypotheses • Formation and development of a hypothesis • Problem and construction of hypoteses. • Language and models. • Questions the acceptibility of a hypothesis • Features of a Scientific hypothesis • The difference between laws and theories • Universal and Statistical generalizations • Scientific explanation • Nature of scientific explanations • Covering law model of explanation	• States the importance of hypothesis in scientific research • Explains the stages of verification of a hypothesis in relation to scientific reserearch • Evaluates the importance of different hypotheses and explanations in establishing scientific knowledge. • Explains demonstrating the difference between scientific law and theory. • Explains a natural event in terms of the covering law model.	20

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
6. Studies Predicate Calculus	6.1 Symbolizes universal, Particular and Singular sentences by means of symbols such as Name letters, Predicate lettres, variables etc in terms of Predicate Calculus	• Differentiates symbols related to Names, Variables and Predicates. • Symbolic formulae with quantifiers and variables. • Well formed formulae • Symbolizing and translation of sentences. • Equal and contradictory formulae	• Understands the nature and objectives of Predicate Logic • Constructs well formed formulae • Symbolization of verbal sentences.	05
	6.2 Identifies the bound and free variales and applies propper substitutions	• Bound and free (independent) variables • Proper substitution	• Identifies free and bound variables. • Applies propper substitution to a free variable.	10
	6.3 Derivation of arguments and proof of theorems.	• Approved rules. • Derivation of arguments. • Proof of theorems.	• Proving arguments and theroems in terms of rules of predicate calculus • Evaluates the manner in which traditional Logic is combined with modern Logic.	20
	6.4 Tree method in Propositional Calculus.	• Rules of truth tree method open/close trees. • Detarmines the validity of arguments by the truth tree method.	• Understands the rules relevant to truth tree of Propositional calculus. • Test the validity of arguments by means of the rules of truth tree method. • Evaluates the relation of the truth	10

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
7.Application of logical principles in relation to the function of electronic circuits.	7.1 Constructs Logic Gates for symbolic formiulae.	• The relation between Logic and Computer Science. • The relation between Boolean and Logical expression. • Truth tables for bacic and secondary Logic Gates. • Constructs circuits for symbolic formulae. • Constructs simple clrcuits for complex ones	tree method used in Propositional Calculus and Predicate Calculus. • Understands the function of electronic circuits. • Identfies the inputs and output of different Gates. • Constructs simple Logic Gates for complex symbolic formulea. • Assesses the importance of Logic Gates in the construction of electronic circuits.	15
	7.2 Uses carno maps to make complex circuits simple.	• Introduces the method of Carno maps. • Boolean expressions and Carno maps. • The rules for the construction of Carno maps for not more than three varlables. • Constructs simplified logic gates for complex symbolic formulae in terms of Carno maps.	• Carno maps constructed upto three variables • Identifies rules related to carno maps •Transfer complex symbolic formulae int simple symbolic formulae.	15

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
8. Demarcates the nature of logical fallacies while studying critical thinking.	8.1 Fallacies in formal arguments.	• Logical thinking based on reason. • The nature of Logical fallacies • Formal fallacies in relation to terms and propositions	• Lists the formal and non - formal fallacies • Distinguishes between formal and non - formal fallacies.	05
	8.2 Tests the nature of non-formal fallacies in arguments.	• Non - formal fallacies. • Fallacies of Irrelevance. • Weak Induction. • Fallacies of Presumption • Fallacies of Ambiguty. • Fallacies of Grammatical Analogy. • Discusses the non - formal fallacies belonging to the above mentioned categories of fallacies.	• Classifies non - formal fallacies • Indicates the differences in non - formal fallacies. • Identifies logical fallacies committed in the use of language.	15

	8.3 The difference between factual statements and evalative statements.	• Language and thought.
		  • Descriptive statements and
		  • Evaluative statemnts.
			• Discusses the validity of ethical statements.	05

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
9. Sudies the nature of Law and legal determinations.	9.1 Different fields of Law.	• The relation between Law and Logic. • Fields of Law	• Describes with understanding the importance of the practical use of Logic in the field of Law. • Studies the different fields of law.	05
	9.2 Analyses the nature of evidence in legal field.	• The Function of the legal field and the nature of evidences. • The ethical views related to crime and punishment	• Demonstartes the relevance of nature of evidence in legal determination. •Analyses ethical views in relation to crime and punishment.	10
	9.3 Deductive and Inductive process of reasonning in the field of Law	• Study of cases in the field of law.	•Involves in case studies of criminal law. •Evaluates the nature of ethical approach in legal determinatio	05

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods

12. Applies methods to test scientific hypotheses	12.2 Analyses the featurs of different scientific tests.	• Methods of Scientific tests
		  • Observation
		  • Experiment
		  • Control Group method
		  • Case study Method
		  • Crucial test
		  • Thought Experiment
		  • Mill's Methods
		  • Features of tests
		  • Errors in tests
			• Lists the different types of Scientific tests.
			• Describes the special features of various scientific tests.
			• Explains how these tests are used in scientific discoveries.
			• Compares the differences of various tests.
			• Evaluates the contribution made by there scientific tests in making scientific discoveries.
				15

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods

13. Uses the concept of probability in practical situations.	13.1 Defines events of a probable pretest.	• The basic features of scientific
		• Concepts of Probaility and their importance
		• Describe probabe pretests.
		• Representation of sets and its elements.
		• Explication of events and the concept of events.
		  - authentic events
		  - probable events
		- simple events
		complicate events
		• Permutation and combination
		• Intersection, union and complement of sets.
		• Independent, dependent, mutually exclusive and non - mutually exclusive complementary events.
			• Understands the practical application of probability in varions situations
			
			• Utilizes Permutation and com bination for solving problems.
			• Analyses mathematically the occurence of events and their relations
				10

	13.2 Explicate probability in different approaches.	• Doctrines of probability and its importance. • Historical concept. • Statistical approach • Psychological approach • Mathematical interpretation.	• Explains various definitions of probability. • Limitations of various interpre tations. • Facilitate mathematical foundation for predicting events.	10

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
14. Application of basic features of measurement in scientific research	13.3 Utilize structures of probability for solving problems.	• Law of integration • Law of multiplication • Conitional Probability	• Take a mathematical approach to explicate events and their interrelations • Arriving to conclusions by probability concepts. • Determine the importance of probability for scientific investigations. • Develop the relation between mathematics and probability.	10
	14.1 Applies meaningfully measurement in science.	• Introduction to measurement its features and function. • Instruments of measurements and benefits of analysis. • Benefits of numbers. • Different types of scales. • Errors of measurement.	• Understands quantification techiniques in scientific tests • Describes the importance of the use of measuring instruments • Explains various scales in data analysis. • Selects ways of minimizing errors of measurement. • Evaluates the importantance of quantitative data as against qualitative data.	20

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods

15. Utilizes statistical methods for increasing desicion making skills	15.1 Introduces the nature of statistics.	• Introduction to Statistics
		• The nature of statistics
		  • Descriptive Statistics
		  • General statistics
		• The advantages of statistics.
			• Apply satistics for desicion making.
			• Evaluates the importance of statistics for constructing scientific generalizations.
				05

	15.2 Monitoring samples for collecting data and information.	• Experiments and data
		• Objectives and foundations of data classification.
		• Samples
		  • Probablesamples
		  • Non probable samples
			• Understands the importance of collection of data in scientific tests.
			• Select most suitable sampling method for scientific experiments.
			• Explains characteristics of fair sampliong.
				05

	15.3 Utilizes the eligible central tendencies for arriving accurate desicion of a statistical distribution.	• Central tendencies
		  • Mode
		  • Median
		  • Arithmetic mean
		  • Weighted mean
			• Identify methodologies of data analyzing and monitoring.
			• Arriving conclusions through the central tendencies.
				05

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
	15.4 Enunciate the expansion of a statistical distribution by the means of dispersion measures.	•Dispersion measures 　•Variance 　•deviation 　•standard deviation 　•variability 　•Relative dispersion	• Utilize statistical methods for numeric data analysis • Generating conclusions of phe nomenon by dispersions.	05
	15.5 Correlational measures	• Correlation methods • Possitive correlations in scatter plot • Negative correlations in scatter plot • No correlation	• Apply statistical methods for the quantification of attitudinal events. • Develop scatter plot/line graph connections through data.	03
	15.6 Explain the errors of statistical usage.	•Statistical errors 　•sample errors 　•non-sample errors	• Select samples to aviod statistical fallacies. • Evaluate mthe protection of objectivity of socialsciences by statistical methods.	02

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods

• 16. Faces future challenges by means of sceintific concept which were nutured before and after the renaissance	16.1 Exhibits past knowledge in modern science	• Historical Scientific concepts
		  • Science before Renaissonce (Indian, Chinese Babylonian, Egyptian,Greek, Arabic and Sri Lankan Civilizations)
		  • Renaissance and Copernican Revolution.
		  • Knpwledge of research done by Copernicus, Tycho De Brahi, Galileo, Kepler, Newton and how they arrived at conclusions.
		  • Scientific concepts and the development of Language
		  • How science relates itself to society during different historical periods.
		• How the facts arising from the above topics are relevant to scientific methodology.
		• The theoretical development of Natural and Social Sciences.
			• Understands how the knowledge of technoligical skills were converted to scientific knowledge.
			• Analyses how both western and Eastern views contibuted to the development of science
			• Gathers information regarding the views of scientists that contributed to renaissance of science
			• Evaluates the contribution of scientists to the development of science
				10

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
	16.2 Analyses modern science and contemporary views and theories.	• Modern and contemporary views of science.• • Views rearding the origin and nature of the Universe. • Theory of gravitation and laws related to motion of physical phenomena. • Views related to origin and evolution of life. • Kinetic theory of gases and laws gases. • Views related to light (Corpuscular, • Models and views related to atom. • The Phlogiston theory and chemical revolution. • Blood circulation (Gallen, Harvey) • Einsteins theory of Relativity • Quantum theory • Mendel and the views of Genetics • Psychology and its schools • Theorieo in Politcal science • Main aspects of Maxism • Keynesian Economic theory.	• Lists the events of nature scientifically • Explains the scientific philosophy that formed the background to scientific views • Evaluation the various views that contributed to the origin of science evolution of life.	15

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
17 Participates in scientific tests maintaining its authenticity and validity.	17.1 Analyse the differcnce between social science and Natural science	• The subject matter of Social Science • Differences between Natural Science and Social Science	• Understands the nature and subject matter of Social science • Explains how Social Sciences differ from Natural sciences.	05
	17.2 Applies social scientific research methods.	• Methods of tests in Social Science • Direct observation and partipatory observation • Control group method • Case study method • Questionnaire method • Interview method • Excavations and the study of documents. • Introspection. • Living in research • Sociometric test.	• Analyzes the differant methods of tests in Social Science. • Constructs a balance analysis of social surveys.	10
	17.3 The substaintiality of the social sciences	• The authenticity and validity of data obtained by the method of tests used in Social Science. • The scientific exposure of social sciences. • Foundational arguments and problems related to it.	• Analyses the challenges for the protection of susbstantiality of social sciences. • Estimate the activites relevant to social sciences.	10

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
18. Faces successfully the challenges posed to society by modern science and technology.	18.1 Observes the relation between science and technology	• Science and Society • How science and the development and society. • Development and science • The Arts and Science • Engineering Technology in SriLanka.	• Understands the challenges posed to social ethics due to the advancement of science and technology. • Ethical problems derived from scientific and technological methods. • Discusses how to work out strategies to minimize ethical problems caused by Scientific research.	15

	18.2 Identifies that the development of science and technology could be used for the advantage and disadvantage of individual and society.	• A comparative view of the aims and function of Arts and Science
		  • Religion and Science
		  • A balance view of the aims and functions of Religion and Science
		  • Modern Science and related problems.
		• Professional problems.
		  • Ethical Problems related to medicine and other professions
		  • Problems related to Science, tchnology, Law and Ethics
		  • Science, technology and environmentar problems.
		  • Ethical problems related to Genetic Engineering.
			• Opens a discussion to the effect that Arts and Science should be interrelated.
			• Analyses the problems posed by modern science and technology.
			• Uses technology to over-come challenges.
			• Exploring strategies to over come interrogations occured due to social scientific and technological development.
				15

Competency	Competency Level	Subject Content	Learning Outcomes	No. of Periods
		• Use of Nano technology • Space technology.		

4. 0 Learning and Teaching Strategies

The Strategies which could be used for executing learning and teaching of Logic and Scientific method had given below

- Discussions

- Brain Storming discussions

- Self Studies

- Debates

- Simulation

- Creating handouts related to the subject.

5.0 School Policies and Programs

It is indeed dominantly concerned that the School based officers should prepare significant programs for transferring curriculum related components into

live actions. Here are some subject related activities given below to promote above circumstance.

- Urge to construct subject related components such as debates, banners, Journals and etc.

- Affording opportunities to refer international Journals, books as well as internet in order to gain knowledge.

- Making practical opportunities to engage in experiments for empowering the subject much closer to the pupil.

- Organize conferences and workshops to identify environmental interrogations.

- Induce students for the scientific Reporting.

6.0 Estimations and Assessments.

It is expected to execute school based Assessments program, covering all relevant competencies and competency levels in each school academic term as well as preparing entitled learning and teaching assessment tools properly.

This syllabus is recommended for the G.C.E Advanced Level Examination, the national level evaluation at the end of grade 13 of schools pupils.

The National Evaluation test related to this curriculum, which is conducted by the Department of Examinations Sri Lanka, will be held on 2019.

All the relevant information and details of nature and the structure of the question paper regarding this evaluation test will be given by the Department of Examinations Sri Lanka.

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