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B.A. SEMESTER II, PHILOSOPHY,
PAPER-LOGIC

CONTENTS

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INTRODUCTORY LETTER

Hello Student,

Here if your warm welcome to you. Hope you must have enjoyed your last semester. It was designed to give you a comprehensive overview of the basics of Philosophy. Besides it must have prepared you to study its branches like logic, Ethics, Epistemology and Metaphysics in more details. Second Semester introduces you to Logic.

Philosophy, you must know is a critical inquiry taking up some very foundational issues and concepts employing reason in turn is backed by some fundamental laws of valid reasoning. Logic is that branch of Philosophy which is engaged in studying these fundamental laws of valid reasoning. Since valid reasoning is the basic requisite for any academic inquiry, Logic gains much significance. In order words logic works as one of the most Primary science lending credibility to literally all the branches of human inquiry.

In your personal capacity logic will help you nature your reasoning skills, help you to form valid arguments, examine validity of arguments, avoid fallacies, distinguish between correct and incorrect reasoning and lend you confidence to arrive at right conclusions. It can be said that anyone who undertakes a systematic study of logic will gain edge over others, especially when we are looking for objective truths.

A few years later you will find that most of the competitive exams have logical reasoning (LR) as one of their very essential components. Obviously your study of logic this semester will be of great help to you.

Let m e also you dear student that Logic is a very systematic discipline. Work a little hard on the basic principles and practice still harder in applying them in different logical exercises. You will feel better prepared when you start applying these principles in offering correct reasoning and form valid arguments in your day to day life-situations.

Wishing you all the best

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B.A./B.SC. (GENERAL) FIRST YEAR (SEMESTER SYSTEM) SYLLABUS

PHILOSOPHY
SEMESTER-II

Paper : LOGIC

Max. Marks	:	100
Theory	:	90 marks
Internal Assessment	:	10 marks
Time	:	3 Hours
Lectures	:	75

AIMS AND OBJECTIVES:

This paper aims at a systematic study of the Science of Logic which is the most effective means of developing logical abstract thinking in us. It tries to provide students with a mastery of Logic so that they can think in clearer terms and be less prone to error.

INSTRUCTIONS FOR THE PAPER-SETTER AND THE CANDIDATES :

(i) There shall be 9 questions in all.

(ii) The first question shall be of short answer type containing 15 short questions spread over the whole syllabus and each to be answered in about 25-30 words. The candidate is required to attempt any 9 short answer type questions i.e. 2 marks of each. It shall carry 18 marks and shall be compulsory question.

(iii) Rest of the paper shall contain 4 Units and each Unit shall have two questions with internal choice. The candidate shall attempt one question from each Unit i.e. - 4 in all.

(iv) For private and reappear candidates, who have not been assessed earlier for internal assessment, the marks secured by them in theory paper will proportionately be increased to maximum marks of the paper in lieu of internal assessment.

The paper-setter must put note (iv) in the question paper.

Unit-I

1. Nature, Scope and Utility of Logic.
2. Terms and Propositions: Kinds of Terms, Connotation and Denotation of Terms. Aristotle's classification of proposition (Square of Opposition-Contradictories), Contraries, Sub-Contraries and Sub-Alterns.

Unit-II

3. Laws of Thought: Identity, Contradiction, Excluded Middle and Sufficient Reason.
4. Argument: Immediate Inference and Mediate Inference. Some kinds of immediate inference : Conversion, Obversion, Contraposition, Inversion.

Unit-III

5. Categorical Syllogism: The Structure and Rules of validity of Pure Categorical Syllogism, Figures and moods, Fallacies of Syllogism.
6. Introduction to Truth-Tables, Negation, Conjunction, Disjunction, implications and Equivalences.

Unit-IV

7. Nature of Induction: Distinction between Deduction and Induction.
8. Kinds of Induction
9. Causation: Nature of Cause, Plurality of Causes.

ESSENTIAL READINGS

1. Copi, I. M. : Introduction to Logic (N.Y., Macmillan, 1972, Hindi Translation available); London : Routledge and Kegan Paul.

2. Copi, Irvin M. : Introduction to Symbolic Logic (Prentice Hall of India), New Delhi, 1998.

3. Cohen and Nagel : Introduction to Logic and Scientific Method (Allied Publishers), New Delhi, 2000.

SUGGESTED READINGS

1. Alice Ambrose Morris Lazerowitz : Fundamentals of Symbolic Logic, revised ed., Holt, Rinehart and Winston, New York, 1962.

2. F.H. Bradley : The Principles of Logic, Oxford University Press, London, 1950.

3. John Dewey : Logic, Henry Holt and Company, New York, 1938.

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Lesson-1

NATURE, SCOPE AND UTILITY OF LOGIC

Structure

1.0 Objectives

After reading this lesson you will be able to:

- State what is logic
- Explain the nature and scope of Logic
- Evaluate the utility of Logic

1.1 Introduction

Logic is one of the most fundamental disciplines which has been serving the knowledge seeking human from very early times. Broadly, we understand logic to be a basic science or a branch of Philosophy. When we say man is a rational animal, the rationality which is being referred is in fact dominated by reasoning. Logic is a normative science which study, Methods, forms, principles, foundational laws and validity and correctness of Reasoning. The first lesson is completely devoted to making you understand – What is Logic? What is its nature? What is scope? and What is its utility?

1.2 Understanding Reasoning

Rationality is the distinguishing characteristics of **Homo Sapiens*.** This general facility is present in all normal men who employ it in a variety of ways to serve a variety of ends. Since

(*) Zoological name of man.

the dawn of consciousness, men had been depending heavily on this faculty which has enabled them to perform myriad forms of mental operations like classification, decision-making, argumentation, calculation etc. All these acts, involving our rational faculty, can be normally categorized under three major-kinds.

(i) Simple Apprehension

(ii) Judgement

(iii) Reasoning

1.2.1 Simple Apprehension (Formation of Concepts)

It is the most simple and foundational operation of human mind through which a man becomes aware of something. Simple apprehension results in the formation of a simple idea or a concept of the things observed, for instance when a flower is brought before us, all our sense organs receive the sense datum provided by it. The *sense datum* after having been organized, lead to the formation of a concept which is normally represented by a linguistic symbol-a word. In logic, this word say 'FLOWER' which stands for the concept of the object flowers is called a *'term'*. Simple apprehension, which yields concepts, in fact provides the building blocks of our knowledge. But until these building blocks are joined together the real process of attaining knowledge can not begin.

1.2.2 Judgement (Formation of Propositions)

Joining or arranging the outcome of two acts of simple apprehension i.e., concepts, yields a judgement (Proposition). Concepts, the constituents of the judgement, are somehow connected, either positively or negatively, to form the most fundamental composite constituent of human knowledge called a proposition in logic. For instance, when we say that *'The Flower is beautiful'* we try to relate two different concepts- flower' and 'Beautiful', together to form a judgement. A judgement provides an information about both its constituents and their relationship. This operation of mind provides a judgement after comparing or juxtaposing or relating two nations or ideas or images or concepts which have been derived from the primary operation of simple apprehension. This operation is also called as an act of composition of division, because two different concepts are either united in an act of affirmation or separated from each other in an act of denial.

The process of formation of judgement takes place in our minds only, whenever we express it in language each judgement is represented by *a statement or a proposition*. You must bear in mind that each judgement represents a fact, therefore it is either true or false. If the judgement truly represents a fact, then it is true if it does not correspond with the fact it refers to, then it is deemed as false.

1.2.3 Reasoning (Moving from known to unknown)

Reasoning is the culmination of the process of attaining knowledge. It is that act of the rational faculty where in one judgement or a group of judgements, after having been joined together, yield new knowledge. For instance when a judgement *'All flowers are beautiful'* is joined with another judgement *'Rose is a flower'* we arrive at a conclusion or a new judgement *Rose is beautiful'.* Like wise from the truth of *'All flowers are beautiful'* the falsity of *'No flowers are beautiful'* can also be concluded.

'Reasoning, thus, is that intellectual operation in which a person arrives at a new piece of knowledge from a previously acquired piece of knowledge. It is a passage of the mind from known to unknown from familiar to unfamiliar.

“Reasoning observes certain universal rules. Validity of any instance of reasoning depends on its compliance with such universal rules and principles. But what is the source of these rules? What are these rules? Who provides these rules? Logic provides these rules, in fact, it studies the general features of all instances of valid reasoning and formulates certain universal principles which govern our reasoning process. These universal principles could be discovered by examining the methods of reasoning as employed in various disciplines, ordinary discourses and thinking. Logic does not invent these universal principles, it discovers them and formulates them. It also undertakes to examine those methods and principles by which proper, valid and consistent reasoning is ensured.

1.3 What is Logic

The word ***"LOGIC"*** has developed from a Greek adjective 'Logic' which corresponds to ***'LOGOS'*** which is its noun, which means either 'thought' or 'words'. Logic, according to its etymological meaning is defined as a science as expressed in language. This etymological definition is a very broad definition and can not serve the purpose properly.

It is really a difficult job to provide a comprehensive definition of the subject in the beginning. However, we can study a few well known definitions of logic and then try to develop our own definition.

Aristotle, who is considered to be the father of Logic, maintained that *Logic is a study of the forms of thought.* In the same vein Hamilton defined logic as *"The science of the formal laws of the thought"*. Sextus Empiricus considered logic as a branch of philosophy whose task is to find, *"Trust worthy principles and methods for the discernment of truth".* Arnauld defined logic as. *The science of the understanding in the pursuit of truth"* Jevons defined logic as *"Science of Reasoning,"* but he agreed with those logicians also who defined logic as *"...the science of the formal or the Necessary laws of thought.* Welton and Monehan defined logic as 'the science of the principles of valid reasoning'. Max Black considered logic “....as the study of reasoning" And Wolf defined Logic as "... the study of the general conditions of *valid inference* (for the proof)".

An examination of these definitions would reveal that:

(i) Most of the traditional logician's defined logic as the study of the laws of thought'. This was quite acceptable in traditional times only because then psychology had not developed as an independent discipline. But today when psychology is considered as a very respectable independent discipline and the study of the laws of thought is its major concern; it would be confusing to define logic as the study of laws of thought. In fact psychology studies all kinds of thought process whereas logic studies only one significant kind of thought reasoning.

(ii) Another popular definition of logic has been *‘Logic is the science of reasoning*. Although it is a better definition but it is quite a broad definition. Because a logician is concerned only with the conditions, tools and products, of reasoning and not with the psychological factors involved in it (Reasoning being a special kind of thinking).

(iii) In the light of above definitions we can define logic as a branch of philosophy, specially devoted to the study of the tools, methods and principles of valid reasoning. Copi and Cohen gives a very precise definition of logic - "Logic is the study of the methods and principles used to distinguish good (Correct) from bad (incorrect) reasoning. The central issue with which logic is normally concerned is valid reasoning, its systematization, development of validity principles and an understanding of all the related notions. Unlike other disciplines logic, true to its nature, adapts an analytical, normative and regulative approach. Being a branch of philosophy, it is more than obvious that it is not at all either a natural science or just a

descriptive discipline. It is a normative science and its objectives are to evaluate various instances of reasoning according to certain, notions, regulative principles and standards. Besides Logic, Aesthetics and Ethics are some other normative sciences which are engaged in prescribing norms of standards explicity, whereas logic prescribed norms regarding the truth and falsity of our judgements. Aesthetics studies the notions of beauty, art, art experience art object. While Ethics examines norms of goodness and rightness for evaluating acts of human-conduct.

Logic has normally been called as a formal discipline since it studies the forms of thinking. In one sense it is true also because logic in fact studies the 'forms' of various kinds of arguments. It is not much interested in the contents of the arguments. A logicians is interested in the forms that run through all our thinking about different matters what he studies. But these forms are not just forms which cannot be substituted by any content.

1.3.1 Nature of Logic

Broadly speaking various disciples and sciences can be divides in three different categories.

Natural Sciences – These sciences study a well-defined areas of nature and natural Phenomena. Sciences like Physics, Chemistry, Geology, study the inanimate part of nature. Sciences like Botany, Zoology, Human Biology, Genetics, Study the life in its natural form. Social Sciences study humans, their behaviour, their engagements is certain specific domains Social Sciences like Economics, Political Science, Sociology must be sounding very familiar to you. Then there are Sciences like Normative Sciences which study different domains on the basis of certain 'Norms' 'standards' Logic, Aesthetics and Aosthetics are three key disciplines which are very poplar normative sciences. Logic is one of the leading Normative science which is governed by its Core Standard Truth and its task is to formulate laws which should ensure that the conclusions we arrive at are True. This way logic is not interested in the facts or the hard core reality though all kits formulated laws will apply to reality only. From this angle we may call it a faunal discipline because being concerned with norms and standards Logic will be more interested in studying the forms and composition of arguments through which we undertake reasoning.

1.4 Scope of Logic

When we talk of the scope of a subject we talk of the subject matter it studies and the problem it deals in. A discipline is in fact defined by its scope which in a way determines the nature and methods of its study. Logic examines thought as a means of cognising the world and rules and principles which regulate the process of our thought. The real concern of Logic with thought is entirely different from other disciplines such as Artificial Intelligence (AI), Computer Science, Psychology, Cybernatics or Neurological science which some how also study thought. These disciplines deal with thoughts as one of their major concerns and examine thought in their own specific manner. Psychology studies thought with a view to understand its causes, its motives and its effects etc. Cybernatics studies thought as it is related to rapid and efficient data processing, preparation of various computer-softwares and to understand the relationship of language and thought. Neurological sciences study the internal process going on within human brain while man is thinking.

Logic in fact, is concerned with the effect of the thought and thought as a means of cognising the world. It studies various rules and principles so as to ensure the attainment of truthful knowledge. Ultimately, it is the true knowledge which would prevail. Man has devised and invented ways of attaining knowledge right from an abacus to a computer. It has even

mastered their gainful applications but until the services of logic are undertaken all the efforts would go waste. It is logic which would formulate rules of valid reasoning and truthful intellectual knowledge. The subject of logic is thought and thought cannot be studied in abstraction. It studies thought in its applications, it studies the laws of thought as they are exemplified in the thinking of many other subjects.

Logic has normally been divided into two major branches-*Induction and Deduction.* In Induction general conclusion is not warranted by its particular premises, whereas in Deduction the conclusion in logically guaranteed by its premises. However both the branches aim at arriving conclusion through valid arguments but their individual way of arriving at the conclusion differ on account of its premises. Induction examines the validity of an argument on the basis of its material evidence whereas Deduction studies the formal validity and it deals with the formal aspect of the argument only. However, the aim of Logic is to ensure valid reasoning which should bear soundness both on the side of forms or content. Logic, as a discipline, can be said to examine thought both in its formal and material aspects.

1.5 Utility of Logic

The ultimate aim of Logic is the attainment of truth. As a normative science it deals with principles of valid thought and reasoning which has helped sciences and other subjects for a long time. But utility of Logic has been disputed by many especially on the ground that it does not help a common man to reason correctly in particular cases and draw right conclusion in his day to day life.

It is true logic does not help to argue correctly in particular cases but that is not the primary task logic performs. The primary task of Logic is to formulate laws or principles which ensure valid thinking and correct reasoning. The real utility of Logic lies in giving answers to questions like: What is correct reasoning? What are those laws following which our reasoning will become valid? These are the principles which men ought to follow in their thinking, so that their thinking or reasoning is valid. And when one knows the principles of valid thinking one can argue correctly in particular cases too. Logic, one could safely say, is an indirect and not a direct aid to correct thinking. It may not teach us how to reason correctly but yes it does give us principles to which correct reasoning should conform.

A thorough study of both forms of Logic-Formal and Material will enable a man to draw conclusions from premises, test arguments, prove validity of arguments, counter or contest arguments, evaluate hypothesis and scientific explanations, rebut a dilemma and identify certain fallacies.

1.5.1 Popular Reasoning

Most of the times a layman falls prey to the influence of "Popular reasoning". Because he is not at all aware that there is in fact a science of valid reasoning having a set of rules which guarantee valid thinking. For instance a layman will believe the conclusion even if it has been drawn from two negative premises or from two particular premises. But all those who know the rules of syllogism will not accept such an argument to be valid. A study of logic will definitely help someone, even in particular instances also, to argue well, or identify the reason in case of particular argument is not considered valid. Logic no doubt is an abstract study which helps men in studying the form of an argument. This in turn would help men is cultivating the proof of abstract thinking.

Logic offers, some very dependable intellectual tools which equip its students to reason correctly, form and evaluate valid arguments in their intellectual discipline, be it a social science or a natural sciences. Logic has been rightly called as the science of sciences because it is with

the help of logic that a scientist is in a position to draw acceptable conclusions for his theories, evaluate his hypothesis and offer scientific explanations. No science is above logic and each scientist has to submit his arguments and conclusions to logical scrutiny. It is not true of scientists only it is true about any one engaged in any intellectual pursuit where thinking involves reasoning, argumentation and validity.

1.6 Summary

This lesson began by giving you an introductory account of what is logic and what is its key nature where we learnt that logic studies reasoning its forms, techniques and laws. This way it is a normative science. Later we learnt what are the key issues logic takes up. Here we learnt that logic is proudly divided in two forms Deductive Logic and Inductive Logic.

Towards the end we studied what are the advantages of studying. Logic. No Doubt logic would offer you very dependable intellectual tools through which you able to reason validity.

1.7 Glossary

Reasoning – It is the mental act of drawing inference from known facts/premises to unknown facts.

Logic – A normative branch of Philosophy which critically studies the fundamental laws, nature and structure of reasoning. Induction and Deduction all two of its major branches.

1.8 Model Questions

1. What is logic, Discuss its nature and scope.
2. Define logic, discuss its scope and utility.

Check your progress

- Define Logic
- Mention two main branches of logic
- What is Reasoning

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Lesson-2

TERMS

Structure

2.0 Objectives

After reading this lesson you will be able to:

- Understand the concept of Terms.
- Explain division of terms.
- Discuss Connotation and Denotation.

2.1 Introduction

In the previous lesson you learnt that the very first step of reasoning is the foundation of a concept, is logic we call it a term. A term is the smallest unit of our knowledge. When we establish a relation between two such units – terms then a proposition is formed. But it is very interesting that term in itself has a world of its own. There a number of types of terms, Terms are simple or composite; they could be abstract or concrete. Besides we must learn what is meant by Denotation or Connotation of terms. This lesson will begin by introducing you to the concept of Term then it will let you understand how a term is different types of terms you will understand the concept of Denotation and Connotation of Terms.

2.2 Terms

A term is a word or a group of worlds which carries the smallest unit of meaning which is definite and either appears as the subject or the predicate of a proposition. You know that prepositions either deny or affirm something of something, else. In the proposition *"All Children are innocent"* an assertion is made about children and something 'innocence' (in this case) is asserted. About which an assertion is made, is called the *subject* and that which is asserted is called *predicate Subject* and *Predicate* are principal constituents of a proposition and both of them are called terms. A *term* (derived from the Latin word 'Terminus' meaning boundary) is so called because it appears at the boundary of any logical proposition. In *"All children are innocent",* both the terms children (subject) and innocent (predicate) appear at the boundaries of this proposition and in between them appears *'copula'* the *'relating factor'* ('are' is copula in this case). The major constituents other than the relating factor, are called *'terms'* one being the subject and the other the *predicate.* A term, in turn, can be defined as a word or a group of words capable of forming principle constituents of subject or predicate of a proposition.

Terms are the words by which we point out the things or classes of things in questions. They are the objects of thought as expressed in words and they perform the logical functions of conveying the meaning. Each term stands either for a subject (e.g., a person, a thing, a group of people etc.) or a class of predicates or qualities (red, heavy, peaceful, fast, rational, innocent etc.)

2.3 Terms and Words

In ordinary discourse "words" and "terms" are considered synonymous but in logic we make a clear cut distinction between the two. Words are simple articulate sounds or written signs by means of which we communicate but terms are the objects of those messages which we communicate through words. Some more differences are being given below :

(i) A term is expressed in a word or a group of words. e.g. *(i)* Pen (one word) *(ii)* Prime Minister of India (Groups of Words)

(ii) The same word may mean more than one meaning but a term along with the meaning it conveys if accepted once, would continue to mean the same meaning. e.g. *(i)* Tear *(ii)* Cell *(iii)* Virus.

(iii) There are some words which cannot stand by themselves as subject or predicate of a proposition e.g. words like 'but', 'how', 'is; 'not', 'the', etc. Such words are called *syncategorematic* words whereas there are certain other words known as Categorematic words which can stand without the support other words. London, Raman, He, Children etc, are such words. Thus *Categorematic* words can become terms whereas *Syncategorematic* words cannot be treated as terms.

2.4 Division of Terms

Different divisions of terms have been recognized by traditional logicians. Following are some more important recognised divisions of terms. .

2.4.1 Simple and Composite Terms

A term made of one word is called simple, while a term made of more than one word is called composite. For example, ‘Ram’, 'India', 'Boy', are simple terms, but, 'Good boy', Great country', 'Prime Minister of India', are composite terms.

2.4.2 Singular and General Terms

This distinction is based on the number of things to which a word can refer. The term which is used for one specific thing or i*ndividual* is called a singular term, while the term which

can be used for any member of a class is called a general term. Thus, Vivekananda, this pen, the capital of India are singular terms, while Man, Pen, Country, Book etc. are general terms. It is important to note the distinction between the name of a specific individual and the name which can be used for any member of a class. Mrs. Pratibha Patil is name of a specific individual. It is, therefore, a singular term. But *'Prime Minister of India'* is the name of a member of a particular class. It is therefore, a general term. Hence a singular term is applicable to one specific individual only, and a general term is applicable to the member or the members of a class. In the case of a general term, it is not important whether it applies to one individual or to more than one individuals or to none. Just compare the following terms:

(i) The President of India

(ii) Chief Minister

(iii) Present King of India

You can very well see that (i) is applicable to one individual only, (ii) is applicable to any of the Chief Ministers of the States and (iii) is applicable to none as there is no individual who can be called by this term, However, all these terms are general terms.

Sometimes a singular term is also used as a general term. For example, the term, Bradman in the sentence, *'Virat Kohli is the Bradman of India'* is used as a general term.

We should distinguish between two kinds of singular terms, (i) proper names (ii) specific designations as uniquely descriptive terms. A proper names is applicable to one specific individual only. But it is not applicable to an individual by virtue of certain qualities or properties or position of that individual. For example, any new born baby may be given the names of “Buddha” or “Vivekananda" etc. These are proper names and they form one class of singular terms. The present President of India is also a singular term as it can be applicable to one specific individual only. But it is applicable to an individual by virtue of his or her position. In this respect it must be distinguished from *Mrs. Pratibha Patil.* Similarly, "the pen in my hand, 'the man left of you, the present principal of the college, "the best boy in the class" are singular terms. But they are different in their logical function from proper names. *Mrs. Pratibha Patil* and 'the Present president of India', though both of them are singular terms, are different in their logical nature. The former is a proper name while the latter is a *uniquely descriptive term* or designation. The distinction is important and must be noted.

2.4.3 Abstract and Concrete Terms

You know that qualities, properties, actions and relations exist in or between things or individuals. A quality, a property an action or a relation does not exist in itself. But it is possible to abstract mentally a quality, action or relation from its actual concrete setting and give it a name. Such a name is called abstract name or term. An *abstract term is the name of a quality, property, action or relation* considered apart from any individual or individual to which it could belong i.e. as an attribute of subjects. For, example, honesty, humanity, character, movement, laughter, friendship, fatherhood, etc. are abstract terms.

As opposed to an abstract term a concrete term is the name of an object or thing which is considered as possessing attributes i.e. as a subject of attributes. For example *Raman, Man, Pen, Pencil, Principal of the college,* etc. are concrete terms.

A concrete term may be singular or general. For example, *'Raman'* is a concrete, singular term but *'Man'* is a concrete general term. An abstract term may also be singular or general. For example *'honesty'* is a singular abstract term but *'virtue'* is a general abstract term.

Mill points out that abstract and concrete terms usually go in pairs e.g., triangle-triangularity, yellow yellowness; man-humanity; generous-generosity. Whereas the abstract term stands directly for the attribute which the concrete term connotes. In other words it refers to a quality which can only exist in some object, any yet be apart from all objects wherever.

The same term may be an term in one context and concrete term in another context. For example, 'Honesty' is concrete when used in "The Honesty of Mahatma Gandhi" and an abstract term-when we use it as "honesty is a virtue" In the former, it is a concrete term as it refers to honesty as qualifying Mahatma Gandhi, is the latter is abstract, since it refers to honesty as a quality is in isolation from the qualifications of any particular person.

2.4.4 Collective and Distributive Terms

The term which is used for the collection of individuals of a class is called collective term while the term which is used for individual and not for their collection is called Distributive term. There term, *'library'* means collection of books. It is, therefore, called collective term. On the other hand the term *'book'* is a distributive term. A few samples are given as below :

Collective terms	**Distributive terms**
Team	Player
Army	Soldier
Garden	Tree
Bunch of Flowers	Flowers
Class	Student

A collective term should be distinguished carefully from a general term. A collective term is used for the collection of members of a class while a general term could be used for any individual member of a class. The characteristics of a general term is expressed by stating that a general term is used distributively, that is, it is used for every member of class. The term *'Player'* is general. It is used distributively for every member of the class of players. As opposed to it, the term *'Team'* is collective, it refers to the term as a whole and is not used in its distributive sense.

It is also important to distinguish between the collective and the distributive use of terms as the same term may be used collectively as well as distributively in different sentences. For example :

(i) The Devadatta family is very rich.

(ii) Everyone in the Devadatta family is down with malaria.

In the sentences (i) the predicate very rich is applicable to the Devadatta family as a whole, not to every member of the family. In the sentence (ii) the predicate 'down with malaria' is not applicable to the family, as a whole, as in that way it would convey no sense, it is applicable to each and every member of the Devadatta family. So, we will see that the term ‘Devadatta family’ is used collectively in sentence (i) while the same term is used distributively in sentence (ii).

2.4.5 Positive, Negative and Private Terms

A positive term is a name that implies the presence of a definite attribute or attributes. Corresponding to every positive term, there can be a negative term. A negative term implies the absence of the attributes implied by the corresponding positive term. Positive and negative terms can be arranged in Pairs such as :

Positive Term	Negative Terms
White	Non-White
Black	Non-Black
Indian	Non-Indian
Popular	Non-Popular
Regular	Non-Regular

In ordinary language negative terms are used with respect to only a few positive terms. But for logical purposes, it is possible to construct a negative term, with respect to every positive term. For example, we can have 'Non-Red' as a negative term corresponding to the positive term Red and 'non-table' as corresponding to the term 'table'.

Positive and Negative terms divide completely the whole universe of discourse i.e., the class with respect to which we are thinking into two parts. Each of these parts exclude the other part but both the parts taken together exhaust the whole universe of discourse. For example, Indian and Non-Indian exhaust the whole class of men. Such terms as excluding each other but both collectively exhaust the whole universe of discourse are called a pair of complementary terms. White and non-white are contradictory and complementary terms.

A pair of contradictory terms should be distinguished from a pair of contrary terms. Two terms which show greatest opposition but collectively do not exhaust the whole universe of discourse are called contrary terms. For example, white and black and Hindu and Muslim may be regarded as pairs of contrary terms. It is to be noted here that ‘black' is not the contradictory of 'white' Black is only contrary to 'white' The contradictory of ‘white' will be ‘non-white'.

"A private term", says-Mill, "is the name of something which once had a particular attribute or for some other reason might have been expected to have it, but which has it not". In brief a private term indicates the absence of an attribute in the object in which its presence could be expected. For example, the quality of having eyesight can be expected to be in a man. It cannot be expected to be in a pen. Therefore, a man can be significantly called blind; A pen cannot be significantly called blind. The term, blind means deprivation at *eye sight.* It is therefore, called a private term. Similarly, lame, deaf, dumb, bold are privative terms.

2.4.6 Connotative and Non-connotative Terms

In order to understand the difference between connotative and non-connotative terms, it is, first necessary to know what is meant by ‘Connotation’ and Denotation' of terms in logic.

It has been mentioned already that a general term is applicable to certain individuals by virtue of certain properties which it possesses. The term *'tree'* is applicable to the objects of a specific kind. The term ‘man' is applicable to the objects or individuals of a different kind. Now, it is clear that the objects which are called by the term *'tree'* possess certain common properties, such as the property of growing in soil, the property of having roots, trunk, branches, leaves, flowers, fruits, etc. Anything which does not possess these properties cannot be called a tree. Thus the term, 'tree' has two functions: (i) It is used to name or to indicate the objects to which that term is applied. Like the term ‘tree’ every other general term has two functions. The function of indicating or denoting the individual objects, and the function of signifying or connecting attributes or qualities of the objects. Thus a term denotes the individual objects and it connotes the common properties of the objects which it denotes.

When I say that this tree is Neem, I am using the term ‘tree’ to denote an object. But when I say that the object is a tree. I am using the term ‘tree’ to signify or connote its properties as tree.

All the individual objects to which a term can be applied form the denotation of the term and all the essential *attributes* which a term signifies form the connotation that term. All the objects to which the term ‘tree' can be applied form the denotation of that term, 'tree’. But the essential attribute which are signified by the term 'tree' and which determine the term 'tree' form the connotation of that term. Thus the property of growing in soil, and the properties of having branches, leaves, flowers etc., form the connotation which determine the term ‘tree' form the connotation of that term. Thus the property of the term tree. All the individual men, Ram, Mohan, Sohan etc. to which the term 'man' is applied form the denotation of the term 'man’. But the properties of being animal and being rational which are commonly possessed by all the individuals whom we call man and which are sufficient for determining the correct use of the term 'man' form the connotation of the term 'man'. In brief, denotation of a term means all the individual objects to which that term is applied and connotation of a term means the essential attributes of the objects to which it is applied.

A term which denotes certain objects by virtue of certain attributes which they possess is called a connotative term. Thus, a connotative term is one which denote individuals and connotes their attributes. It has denotation as well as connotation. All concrete general terms, such as man, tree, pen, pencil, book, chair etc, are connotative.

A singular term which is uniquely descriptive term is also connotative term as it is applied to a specific individual by virtue of its possessing certain attributes. Thus, "the present President of India" is a connotative term.

The term which only name individuals or qualities are non-connotative terms. For example: Ram, Mohan, Hari, honesty, humanity etc. are non-connotative terms.

2.5 Denotation and Connotation of Terms

A term can be seen from two angles-one from the angle of all the objects of which the term is true and from the angle of its sense or intension. The sum of qualities implied by a term. The former angle would be covered under the denotation and the latter under the connotation of terms, for example the denotation of the term “FLAG’ would be all instances of object 'flag' which existed, are existing and would exist. The connotation of the term ‘flag' would be the sense or the sum total of all the attributes which are present in the mind of any person employing the term e.g., it has a banner of some special colour bearing special signs which fits into a staff and it represents a particular group.

Connotation of a term generally signifies the set of essential attributes of the object. Logically speaking when we refer to the connotation of a term we mean all the necessary and essential characteristics which are sufficient to 'define' that term.

Denotation and connotation of a term are independent, this fact needs no reiteration but we must know that denotation of a term depends upon its connotations. Because before identifying an object as belonging to a particular class of teams we must know before hand the connotation of the term. But this does not, in any way, mean that denotation of a term would be lesser importance. It would be rather more honest to say that denotation and connotation of a term go hand in hand; talking of one without any reference to the other is not possible. Sometimes there are terms which have no members at all. Like when we say a *‘barren's son', 'unicorn', 'golden mountain'.* It amounts to saying that there can be some terms which do have a specific intention but no members.

2.5.1 Relation between Denotion and Connotation

As we study the relationship of the denotation and connotation we observe that both have relation of inverse variable between themselves. As the connotation of a term increase the denotation would reduce and vice versa. For example when we talk of Animals the term animal has a broader meaning with user specifications, it would include vertebrates and invertebrates both and hence the number of the members would be very high. But when we talk of the term *'Blue whale'* the characteristics of the term would be more in number and comparatively the number of its members would be too less.

Although denotation and connotation of terms are antipolar but they keep a very characteristics relationship between them. Neither could be thought without the other. Cohen and Nagal righty put it, "why a term is applied to a set of objects is indicated by its intentions the set of objects to which it is applicable constitutes its extension".

Check your Progress

Q.No. 1. Determine the Logical nature of the following terms: Man, State, General Library, Honesty, Dumbness, Delhi, Raman.

Q.No.2. Match the two

1.	Honeybee	(a)	General term
2.	Raman	(b)	Relative term
3.	Father	(c)	Singular term
4.	Irregular	(d)	Abstract term
5.	Honesty	(e)	Negative term
6.	Army	(f)	Private term
7.	Blind person	(g)	Collective term.
e.g. (2)	**Raman**		**Singular term**

Compare your answers with the answers given on the next page.

Key to Q. No. 1 & 2

Answers

A-1. Write the Logical Nature of the terms :

Man :- Simple, General, Non-Collective, Concrete, Connotative and Positive.

Library-Composite, General, Collective, Concrete, Absolute, Connotative and Positive.

Honesty:- Simple, General, Non-collective, Abstract, Positive, Non-connotative.

Delhi :- Simple, Singular, Non-collective, Concrete, Positive, Non-connotative.

Dumbness :- Simple, General, Non-collective, Abstract, Positive, Non-Connotative.

Raman :- Simple, Singular, Non-Collective, Concrete, Positive, and Non-connotative

A-2. Match the two

1. (a)
2. (c)
3. (b)
4. (e)
5. (d)
6. (g)
7. (f)

2.6 Summary

This lesson began by introducing you to the concept of Terms as the first step of process of reasoning. Terms you learnt are the principle constituents – subject or predicate of a proposition. A term can be reached from two directions – when we move from the objects/things which are referred by term we are all dealing with denotation of terms and when we access term from the attributes and qualities then we deal with their connotation. This lesson further introduced to different types of the terms. Later you learnt the concepts of Denotation and Connotation and their relationship in details.

2.7 Glossary

Term – A term is a word or a set of words having only one meaning, it forms the two essential elements (as subject and predicate) of a proposition.

Denotation – Denotation of a term is the object or the thing to which it refers.

Connotation – Connotation of a term is the set of qualities or attributes which are possessed by the object to which it applies.

2.8 Model Questions

1. What do you understand by a term? Explain what is meant by Denotation and Connotation of a term, how the two are related.
2. State four important types of Terms, give examples to support your point.
3. Write short notes on two of the following:
   (a) Singular and General Terms
   (b) Term and Worlds
   (c) Concrete and Abstract Terms

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Lesson-3

ARISTOTLE'S CLASSIFICATION OF PROPOSITIONS

Structure

3.0 Objectives

After Reading this lesson you will be able to:

- Understand the concept of Proposition.

- Analyse and Classify different kinds of prepositions.
- Explain Square of opposition and its significance.

3.1 Introduction

This lesson will give you a comprehensive idea of Aristotelian Classification of prepositions. This will also give you a fair idea. How logicians from Aristotle onwards tried to articulate most fundamental laws of thought. We will first begin by analysing a proposition and they shall study classification of propositions as recommend by Aristotle. Later, we will have a look at square of opposition which will give you a comprehensive idea of different forms of logical relationship. Square of opposition is a very effective way of understanding of drawing immediate inferences from different forms of propositions.

3.2 Propositions

Propositions represent facts, they either deny or affirm something of something. A proposition is true when the fact it represents is actually so. It is false when what is represented in the proposition and what actually exists, do not match. We can say that a proposition is an assertion of a relation between two things (Subjects and its attributes) known as terms. Propositions are expressed in sentences which are nothing but arrangements of words capable of conveying some meaning Sentences may or may not conform to the standards of usage or tastes they may be grammatically correct or incorrect, they could even be absurd, but despite that they would continue to be sentences. Consider the following set of sentences :

1) Why have you taken up philosophy?
2) Philosophy is sister-in-law of loneliness.
3) Oh God ! Make me immortal.
4) Please help me.
5) Get out from this room
6) Taj Mahal as situated in Agra.

Sentence no. (1) cannot be a proposition because it neither affirms anything nor does it deny anything, it is just an interrogative sentence. Sentence no. (2) is a very peculiar kind of a sentence, it is neither an inquiry nor it is an assertion, apparently it appears to establish something but is just an absurd sentence. Sentence no. (3) is just a wish whereas Sentence no. (4) is a request. Sentence no. (5) is an order. Therefore these sentences do not qualify to become statements. Only Sentence no. (6) can be considered as a proposition because it makes an affirmative assertion of the fact - ‘Taj Mahal is situated in Agra’. Remember only such sentences, which are capable of making positive or negative assertions are known as indicative sentences and only they can qualify to become propositions.

3.2.1 Proposition and Sentences

Propositions should not be confused with sentences. We must know that :

(i) A sentence is an arrangement of words whereas a proposition is what is expressed through an indicative sentence.

(ii) A sentence has some kind of physical existence whereas a proposition is an abstract assertion only.

(iii) A sentence is always a par of a language, whereas a proposition is not peculiar to any of the languages.

(iv) A proposition involves a subject and a predicate, in which a relationship is either asserted or denied but a sentence may comprise of more than one subject or predicate.

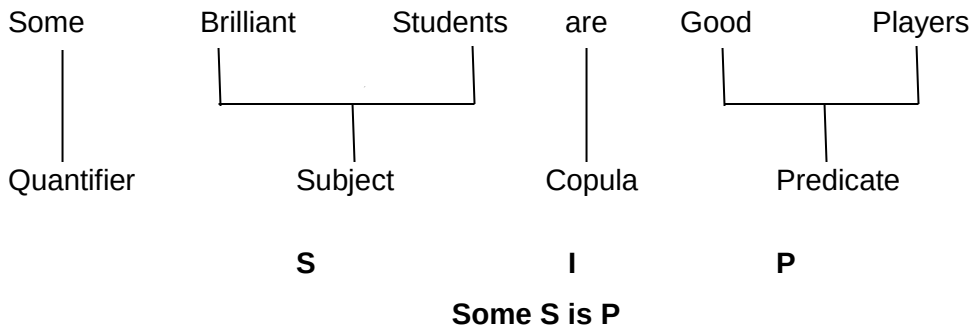
A proposition, we have observed, represents a truth or falsity, or it either asserts or denies a relationship between the Subject and Predicate. The truth or falsity of a proposition is ascertained on the basis of its correspondence with the fact it states. A fact is an event, a phenomenon or a fragment of reality that is an object of man's practical or mental activity.

A proposition e.g., *'New Delhi' is the capital of our country'* is true because it corresponds with the fact that all the highest seats of the Government, the Supreme Court, the Parliament, all the Ministeries etc. are situated in New Delhi only. A proposition like, Chandigarh is a seaport' is untrue because Chandigarh in not at all situated near a sea.

In deductive logic we are concerned with truth and falsity of a proposition, however; our primary concern is not their truth or falsity, only. We simply assume them as true or false. For that we have to depend on 'Observation', and deductive logic does not acknowledge observation as its starting point. Logic is mainly concerned with the relationship of different propositions and the classification to propositions.

3.3 Analysis of a Proposition

If we carefully analyse an indicative sentence then we would find that a simple proposition comprises of two terms : Subject and predicate joined by a Copula. Examine the following proposition :



Some S is P

That term about which some assertion or denial is made is called a *Subject* (S) and that term which is asserted or denied about a subject is called a *Predicate (P).* Subject and Predicate are two terms connected by a *Copula.* This connecting factor merely expresses a relation between two terms. By itself it does not either assert or deny any of the two terms. Copula should always be some part of the verb 'to be' and it may be in the form of *are, am, all, is, as not, etc.*

3.4 Classification of Propositions

Propositions have normally been classified into following six different kinds.

3.4.1 Simple and Compound Propositions

On the basis of structure we can divide propositions into two types: Simple and Compound. A proposition is said to be simple when it consists of two terms and affirms or denies their mutual relationship. *'Raman is handsome'*, *'snakes are reptiles'*, *'Some politicians are corrupt'* etc. are examples of simple propositions.

A proposition is called a compound proposition when it contains more than one statement or in other words it consists of more than two terms e.g., *'Raman is handsome and obedient'.* .This is in fact a compound proposition because it could his reduced to two propositions.

(i) Raman is handsome, and

(ii) Raman is obedient;

3.4.2 Division according to relations

On the basis of the relation of predicate to the subject, propositions can be classified into two kinds:-

(i) Categorical

(ii) Conditional .

i) Categorical :- A proposition is called a categorical proposition because relationship between the subject and predicate is unconditional and without any *emphasis the following propositions :*

a) All fat persons love sweets.

b) Some cats are pets.

c) No woman loves fashion.

All the assertions in a, b and c are categorical and unconditional.

ii) Conditional propositions :- Conditional propositions can further classified into two types Hypothetical and Disjunctive.

(a) Hypothetical proposition :- Those compound propositions which are in the form of If…...and then form e.g., *If he is a cheat then he should not be honoured, are called* Hypothetical propositions.

a) If Radhika is brilliant then she would succeed. If S is P- then S is M

b) If he is non-vegetarian then he would attend the dinner; antecedent consequent.

c) If it does not ram tomorrow then the play would be resumed.

(b) Disjunctive Proposition :- A compound propositions is called a disjunctive proposition when two simple categorical propositions are connected with each other with ‘or' in between : for instance

a) Either the cloth has shrinked or I have gained some weight.

b) Either the students are lazy or they have lost interest.

c) Tushar is either obedient or disobedient.

3.4.3 Division according to Quality : Affirmative or Negative

This type of classification of proposition is based on the quality of a proposition which is determined by the kind of relation which holds between the subject and predicate. If the

predicate is affirmed of the subject then the proposition is affirmative and if it is denied of the subject than it is considered as a negative proposition.

Examples

	Affirmative		***Negative***
a)	*All men are rational*	*a)*	*No man is irrational*
b)	*Some babies are very active*	*b)*	*Some babies are not very active*
c)	*All wealthy persons are lucky*	*c)*	*No poor are lucky*

Quality of a hypothetical proposition is determined by the quality of its consequent. If the Consequent are affirmative the prepositional is acknowledged as affirmative and Vice-Versa.

i)	*If Latika is innocent, she is also honest*	*Affirmative Hypothetical*
ii)	*If Shuchi is not shy. Her friend Supalka will be bold*	*Affirmative Hypothetical*
iii)	*If it rains, he will not turn up*	*Negative Hypothetical*

3.4.4 Division according to Quantity

We know that each logical proposition supplies some information regarding its scope. A proposition which predicate something of all the numbers of a class is called a universal. If it predicates something of an indefinite part of a class for instance "Some girls are. Kind it is called a *Particular proposition.*

A Universal proposition - is one in which we affirm or deny a predicate of the entire class.

(i) All children are innocent

(ii) No girl is miser

A particular proposition is called so because the predicate is affirmed or denied of a part of the class of the subject e.g.

(i) Some dogs are not good looking.

(ii) Some TV Programmes are very informative.

‘All’ ‘Every' 'No' etc. Quantifying words are used to denote the universal quantity of a proposition. Whereas *'Some, 'A', 'Few’, 'Not all', 'Some not'* etc. are particular quantifiers. We must make it clear that the word 'some' is used when the entire term is not referred. ‘All’ quantifier would only be used when the reference is made to the entire class; even I difference would make the proposition a particular, proposition. Thus when the scope of reference of term is 1% to 99% the quantifier *'some'* or some not should be used. To be precise in logic 'some" should mean 'at least one' instance and a particular negative proposition denies that there is at least one such S which is not P.

Quantity of Hypothetical proposition is determined by the quantity of the "antecedents e.g., If A is B; C is D (Universal proposition). If some cases of A is B, C is D (Particular proposition).

3.4.5 Division according to Modality

Modality is a character of a proposition which refers to degree of assertion. It is the degree of a certainty with which a predicate is either denied or affirmed of a subject. In traditional logic propositions were divided in to *Necessary, Assertory* and *Problematic* on the basis of modality.

A proposition is called Necessary when the relationship between a predicate and its subject is universally true e.g ‘Y must follow X', or ‘2 is smaller than 3' 'The sum of the angles of a triangles is equal to two right angles.

A proposition is considered Assertory when the relation between Subject and Predicatre is established on the basis of our experience; they are true of false as far as our experience extends e.g., *No Pengui can fly or* ‘All crows are Black". We know these facts on the basis of our experience only. A possible element their falmay ability cannot be logically ruled out.

When the relationship between subject and predicate is only probable, a proposition is considered 'Problematic’. Such propositions are not universally true, however, they are true under some circumstances and false under others. *“It may rain tomorrow’* or *'He might join us".*

3.4.6 Division according to Import

i) Analytic or Verbal Proposition, and

ii) Synthetic or Real Proposition.

A proposition is called Analytic (Verbal Proposition) when the predicate states merely a part of the connotation or in other words when no few information is offered by a proposition and it merely analyses type connotation of a term e.g., 'A bachelor is an unmarried male, and 'A triangle has three angles'. In both the instances no new information is arrived at. The meaning of the term 'bachelor' or a 'triangle' has been simply analysed. A *Synthetic proposition (Real Proposition)* is called so because its predicate affirms an additional fact which the analysis of the connotation could not yield. Such propositions convey new and accidental information e.g. *'A crow, is black ? ‘All dogs are faithful', ‘Grass is green'* etc. The blackness of crows, the 'faithfulness of dogs 'the greenness of grass' are undeniable attributes of their subjects but definitely these attributes do not form a part of the connotation of the terms.

3.5 Traditional Four-fold Scheme of Categorical Proposition

Categorical proposition having the same subject and predicate can be classified into four different kinds on the basis of quality and quantity.

A propositions can be either universal or particular and can either be Affirmative or Negative. Taken together there can be four types of categorical proposition :

1.	**Universal Affirmative**	**All Saints are Pure hearted**	**All S are P (A)**
2.	**Universal Negative**	**No Schools are prisons**	**No S is P (H)**
3.	**Particular Affirmative**	**Some Speakers are proud**	**Some S is P (E)**
4.	**Particular Negative**	**Some Snakes are pets.**	**Some S is not P (O)**

AEI and O, the first four vowels of English language have been customarily used to stand for these four kinds of categorical propositions. These letter names are presumed to come from two Latin words **'Affirmo’** meaning **‘I affirm'** and **‘n EgO’** meaning **'I deny'**.

These four types of propositions observe different relation with the other three types e.g., A propositions always contradict a propositions, E propositions Aristotle in his *Traditional*

Square of Opposition has very explicitly stated the type of relation each propositions has with other propositions. We shall study these relations in the following pages.

3.6 Square of Opposition

You mare aware that an inference is an act of reasoning by which you can draw certain conclusion from some given premises, or: premise. There are two types of inferences *: namely, immediate inference and mediate inference.* Those inferences are said to be *immediate inferences* in which conclusion is drawn from *just one premise only.* On the other hand immediate inferences are those inferences in which a conclusion is drawn from two or more premises. In the present lesson, We shall introducer you to the nature of 'immediate inference and the rules by which we determine the validity of such inferences. We shall be giving a detailed account unit of these inferences and their distinction, in the forth coming lessons.

The aim of traditional theory of *immediate inference* was to specify a set of conditions by which it would be possible to move from any single statement in the appropriate form to every statement which could be inferred from it alone. This aim was achieved with the help of the *square of opposition.*[*] You would remember that standard-form categorical propositions having the same subject and predicate terms may differ from each other in quality or in quantity or in both. This kind of difference was given the technical name. "Opposition" by older logicians, and they correlated some important truth conditions with various kinds of oppositions.

3.6.1 Contradiction

If you remember the illustration of square of opposition and the patterns of distribution, which we have reproduced above, then you would realize that two propositions are contradictories. If and only if one is the denial of the other in such a way that they cannot both be true and they cannot both be false-together. Thus A and O propositions.

All Poets are dissidents (SAP)

and

Some Poets are not dissidents (SOP)

Which are opposed both in quantity and in quality could obviously be called as contradictories. The truth of either implies that falsity of the other. Exactly one is true, and exactly one is false. The same would hold good in the case of E and I propositions.

No Politicians are honest (SEP)

and

Some Politicians are honest (SIP)

are opposed both in quantity and quality, and are contradictories.

3.6.2 Contrary Propositions

Two propositions are said to be contraries when they cannot be true together, though they might both be *false together.* According to the traditional view of

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[*] Refer Appendix II

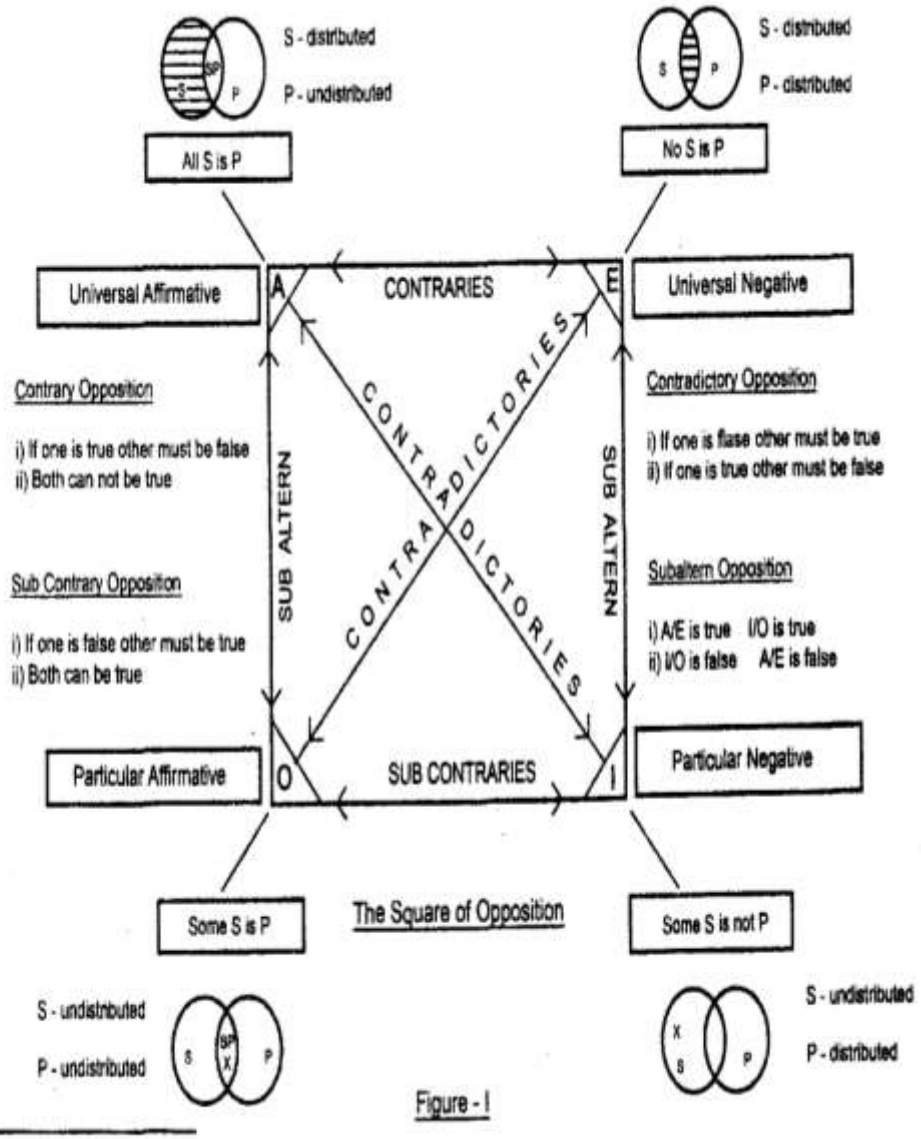


Figure - I

* Refer Appendix II

classification, universal propositions having the same subject and predicate terms but which differ in quality are contraries. Thus A and E propositions :

All Artists are Sentimental (SAP)

and

Non Artists are Sentimental (SEP)

cannot be true together although both might be false, and are to be regarded as contraries.

3.6.3 Sub-Contrary Propositions

Two propositions are known as sub contraries when they cannot both be false though they might both be true propositions which are particular and have the subject and predicate but which in quality, are regarded as sub contraries in the traditional Aristotelian system of classification. Thus I and O Proposition.

Some students are industrious (SIP)

and

Some students are not industrious (SOP)

could both be true but could not both be false.

3.6.4 Subaltern Propositions

Besides these relations of disagreement between proposition, there are relations of agreement also between propositions in the traditional square of opposition. Thus from the truth of an "A" Proposition the truth of an "I" Proposition is supposed to follow, and from the truth of an E proposition, the truth of an O proposition, supposed to follow. Thus that *"All bright persons am bachelors*"/SAP) is true implies that *"Some bright persons are bachelors"* (SIP) is also true. But form the truth of *"Some bright persons are bachelors"* (SIP). One cannot infer anything about the truth of *"All bright persons are bachelors"* (SAP)

3.7 Immediate Inference

If Given	**Then Inferred**		
A True	E False	I True	O False
E True	A False	I False	O True
I True	A Undetermined	E False	O Undetermined
O True	A False	E Undetermined	I Undetermined
A False	E Undetermined	I Undetermined	O True
E False	A Undetermined	I True	O Undetermined
I False	A False	E True .	O True
O False	A True	E False	I True

Thus we can see that with the understanding of the traditional square of opposition and the principle of distribution, it is possible to infer the truth or falsity of other of statements with the same subject and predicate, once the truth or falsity of one of the types is given. Besides the traditional quare of Oppositions, there are other kinds of immediate inference also which shall be discussing in one of the forthcoming lessons.

Appendix I

For a quick glance use the table given below

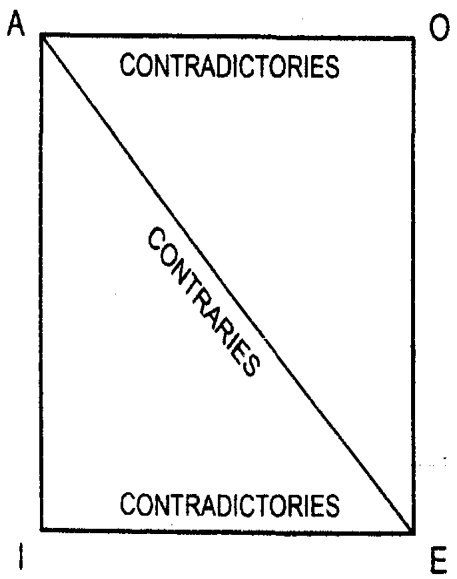
Given ↓		A	E	I	O
A	True		False	True	False
	False		Undetermined	Undetermined	True
E	True	False		False	True
	False	Undetermined		True	Undetermined
I	True	Undetermined	False		Undetermined
	False	False	True		True
O	True	False	Undetermined	Undetermined	
	False	True	False	True	

Immediate inferences – at a glance

Appendix II

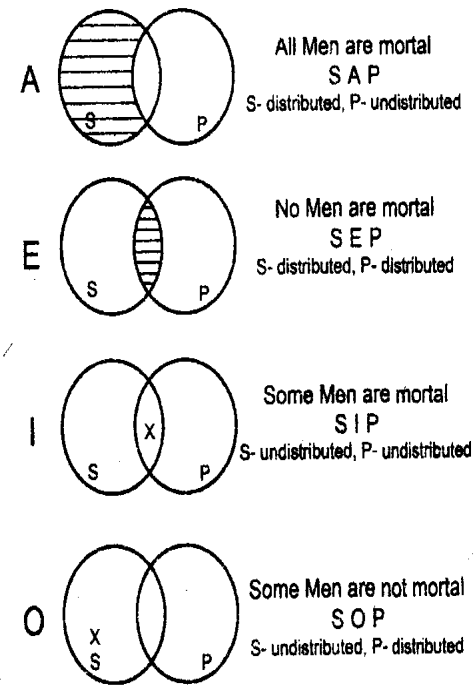
Aristotalian Square of Opposition

The square of opposition presented by Aristotle was quite different from the one you have studied just now. Aristotle accepted only two kinds of opposition -CONTRADICTORY and CONTRARY. Only A & O and I & E were contradictories and A & E were considered as contraries. Aristotle did not entertain the opposition to be different from either contradictory or contrary. He held that opposition was strict opposition wherein two opposition propositions could never be true together.



ARISTOTLIAN SQUARE OF OPPOSITION

Fig - A



Venn's Diagrams of Categorical Propositions

3.8 Summary

The lesson gave you began by introducing what is a proposition then moving on to make you understand what are the constituents of a proposition. Aristotle has done a good job is classifying different forms of Propositions and arranging there is a very useful pattern in a square of opposition. This diagrammatic representation is almost on at a glance of how the four main propositions AEIO are related.

3.9 Glossary

Opposition – A logical relation which holds between two propositions sharing their subjects and predicates but having different quantities and qualities, opposition could be contrary, sub-contrary, contradictory, sub contrary, etc.

Proposition – A statement or assertion of a certain relationship between two constituent terms, being an assertion a proposition has to be either true or false.

Immediate Inference – A form of an inference where the conclusion is drawn 'immediately' from a single premise as in opposition of Propositions or in educations like-obsessions, Inversion.

3.10 Model Questions

1. Discuss different divisions of propositions according to their quality and quantity.
2. What do you understand by Square of opposition? Discuss forms of opposition like – contraries, sub contraries and contradictories

Lesson- 4

LAWS OF THOUGHT

Structure

4.0 Objectives

After reading this lesson you will be able to:

- Understand the concept and kinds of laws.
- Explain the three laws of thought.
- Evaluate the significance of laws of thought.

4.1 Introduction

By now you must be clear as to what kind of efforts Logicians are making. You will also remember one of the definitions of Logic-Logic is a study Laws of thought. Obviously laws of thought are so very crucial and important. In this lesson we will study the most fundamental three laws or may be four. These laws of thoughts are “Axioms of Inference” or “The Universal postulates of reasoning” which provide the very foundation of proof. Logic, as you know is seeking truth. These laws are the tests of the truth.

Consider the following arguments :
Climate of all hill-stations is very pleasant
Shimla is a hill station
Therefore Climate of Shimla is very pleasant.

Flash Floods and freaks hails storms are attributed to a large scale feeling of trees. In the recent past these flash floods and freak hailstorms had played havoc in many parts of Northern India. We can say that all this can he due to a large scale felling of trees in this region and the increasing pollution of environment.

Whenever we come across such arguments we show little doubt in accepting them as valid. Because they are based on reason whose universality can never be doubted. Despite different styles, various expressions and particular ways of thinking every human being thinks according to certain laws. These laws in fact, are certain uniformities or agreements which

exists, rather must exist, in all the modes in which all persons think and reason, so long as they do not make what we call mistakes or commit fallacies. These universal principles which, they abide by are called Laws of thought. Their importance can be judged from the fact that very often logic is defined as the study of laws of thought.

4.2 Kinds of Laws

Before we discuss these laws let us discuss the nature of such laws, but still prior to this let us understand what is a law. A law has been defined as a body of enacted or customary rules recognized by community as binding…… Further it has been accepted as the statement of a general truth, in our work-a-day world we categorized these laws into two categories.

1) Man made laws of State or of a Society, or a game or of a particular system. This type of laws are formulated by a group of men and their motive is to ensure an efficient and smooth functioning of a State or a Society or a game or a system. Such laws cannot only be changed but they can be violated also if one desired so.
2) Laws of nature like the law of gravity, law of motion etc. are the expressions of some uniformities of nature. These laws can neither be violated nor can they be changed. Like you cannot imagine to walk on water or go against the law of gravitation.

4.3 Laws of Thought

In comparison to these *laws, Laws of thought* are very different. They are not manmade laws unlike laws of the state. They are fundamental and necessary principles which lie at the base of all reasoning. Unlike the laws of nature we can even violate them though at the cost of validity of our reasoning. These laws of thought are fundamental self evident uniformities which are not subject to any modifications at any stage. We must add here that they should not be treated as standards of how thought ought to be rather they simply refer to certain characteristics of our thought. Since the times of Aristotle following three laws of thought have been recognized as the fundamental land of thought.

1. **Law of Identity**
2. **Law of Contradiction.**
3. **Law of Excluded Middle.**

4.4 Law of Identity

The simplest statement of this law is the formula. A is A or every entity is what it is Logicians would state it as : if a preposition is true then it is true. Some other expressions of this law are :

Every entity is identified with itself

or

What is, is

or

Every entity is equal to itself

or

If anything is S, then it is S

or

An Indian is an Indian.

This law has its primary application in the meanings of the logical terms. A term should have a clear, distinct; unambiguous meaning and once the meaning has been accepted it should hold good during the course of discussion.

The law of identity asserts that if a proposition is true it is true. This seems to be very obvious, in logical terms it appears to be a tautology* but why then it is a law? The answer is very simple. Whenever we think or argue we assume that a particular entity is such and a particular proposition is true. According to this law during the entire course of discussion or thought we should not entertain any alteration. If a proposition is accepted as true it would remain to be so and if a term is considered to mean *'something'* then it would continue to mean the 'something'. But one may point out that at many instances the same proposition is considered to be true if it is true at the time and place, when and where the statement is made e.g. Mr. Ram Nath Kovind is the President of India will remain true with regard to a particular place and time. We may now generalize this and state the Law of identity as : if it is *anything whatever whenever then A is A*. This is true everywhere and always. The Law of Identity thus ensures that if we start with an assumption that possesses such and such an attribute, we must always admit that and if we assign certain meaning to a term then we must always adhere to that at least in the same course of discussion.

Objections have been raised against this law from time to time such as it is not universally true, because a proposition may be true at one time and false at another. For instance *"Mr. Ram Nath Kovind is the President of India"* wouldn't be a true statement in 2254 A.D., whereas it should have been true for all time to come. This objection can be simply answered by saying that in the present proposition time and space factors have been taken for granted and without reference to these two factors this proposition it is one the proper kind of a proposition. The true form of proposition should be like the one given below.

In March, 2020 Mr. Ram Nath Kovindis the President of India. This clarification can further help us in understanding that "A is A" would remain true despite the fact that the world is constantly changing like a flower river.

4.5 Law of Contradiction

Most simple expression of the second law of thought 'A cannot both B and no B' it implies that nothing can at the same time and place have contradictory and inconsistent qualities. A piece of cloth can be white somewhere else or it might be white at one time and black at another but it cannot be possible that the same piece of cloth is black and white at the same place and at the same time. Once you start a car, either its engine is on or it is off, it cannot be on and off at the same time. It is the very nature of each entity that if we assert one quality about it we can not deny the same quality simultaneously *"It is the very nature of the existence* that a thing can not be otherwise that it is, and it may be safely said," says Jevons "that all fallacy and to error arise, due to this" All statements in which two contradictory properties are asserted, always violate this law and they must be taken as impossible and false the statements like the statement given below :

(i) India is a developed country and not a developed country.

(ii) Logic is an interesting subject and not an interesting subject.

(iii) His wife is fat and not fat.

Following are some expressions of the law.

(a) An Indian cannot be at the same time both an Indian and not an Indian.

Or

(b) Anything for not be S and not S together.

Propositions of this type are contradictory propositions and in Logic there is/are not no place for such propositions. Because it is the non-contradiction which we must try to achieve in Logic and it is one of the pre-conditions of valid thinking. The even universality of this principle

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* Tautology Repeating the same Fact Or Idea in different words.

has been denied on the ground that in some cases two contradictory propositions can both be true. The shirt is wet and the shirt is not wet' or 'He is tall or not tall'. This apparent violation is resolved only be providing the missing information about the place and time factors. If these omissions are supplied, the two of the above stated propositions would not sound contradictory.

4.6 Law of Excluded Middle

The *Law of Excluded Middle* can be represented by this statement A is either B or not B. It states that either an entity is something or is not something there is not in between possibility. Unlike the law of contradiction it indicated the possible aspect of an entity, it shows that only two types of attributes of an object exist: positive or negative, true and false and every object must have either of the two attributes. Anything in between the two has to be excluded. Hence the law is called the *Law of excluded Middle.* Following are some expressions of this law :

(a) Anything has to be either S or not S.

Or

(b) A Man is either an Indian or not an Indian.

Whereas the law of Contradiction forbids us to think that two contradictory attributes can together be present in the same object, the *Law of Excluded Middle* forbids us to think that they can both be absent together. We agree with Jevons that this law is much less self evident that the first two laws. But an objection can be raised against it. Consider a proposition: *Students are either brilliant or non-brilliant,* it may be pointed out that there are mediocre or average student also. This objection points to a discussion which is of great importance in logic and when neglected it often leads to a fallacy. This statement never affirm anything about an average student but only refers to either brilliant or non-brilliant students. It can be pointed out that the attributed 'Non-brilliant' student would include average mediocre and less than average. Students also in other words when both the alternative attributes are starts then the entire possibility is exhausted. Thus by stating. *'He is either a genius or non-genius' we exhaust the possibilities.* Thus by stating, *'He is either a genius or non-genius' we exhaust the possibilities of all alternative assertions.*

These three laws being universally and necessarily true to whatever things they are applied, become the basis of reasoning. The recommend us to assign only one meaning to one term, either positive or negative, at a time and rule out the possibility of any Middle.

4.7 Law of Sufficient Reason

G.W. Leibniz, a 17th century eminent German Philosopher, propounded the Law of sufficient season which states -*whatever exists or is true must possess sufficient reason for being so and not otherwise.* The principle expects that each true thought must be sufficiently substantiated, which would mean that every event must have a cause and every preposition will have some logical ground for being a true proposition.

Leibniz formulates his principle in the following few sentences.

(i) "Nothing comes to pass without a reason" "(nihil fit sine ratione)"

(ii) "There must be a sufficient reason for anything to exist, for any event to occur, for any truth to obtain".

(iii) *Nothing occurs for which it would be impossible for some one who had enough knowledge of things to give a reason adequate to determine why the thing is as it is and not otherwise."

Probably two important issues were going in the mind of Leibniz when he propounded his Law sufficient Reason Firstly he noticed that there are two kinds of truths--the truth of reason and the truth of facts. The former, be observed as law of wisdom and necessary truths, whose opposites are not at all thinkable. The latter, the truth of facts, are contingent and their opposites are possible. The former is based on the laws of identity and contradiction whereas the later truths are supported by the law of Sufficient Reason.

Secondly he must have been using 'Reason' but meaning 'cause' thereby. In other words when he says that nothing happens without a reason then he means to say that nothing happens without a cause. In other words his law of sufficient reason could be better known as Law of *Universal Causation."*

Whether Leibniz's Law of Sufficient Reason plays a great role in 'all our reasoning' is a debatable issue. But one thing could be said with certainty that he himself referred to his own principle rather very frequently especially when he was discussing absolute space, absolute time the existence of God.

Leibniz firmly holds that his Principle law of Sufficient Reason is as fundamental as the three fundamental laws of thought i.e., Identity law of Non-contradiction and law excluded middle. But on a closer scrutiny one can see that the law of *Sufficient Reason* is more sufficiently formal enough so be equated with the three Fundamental laws of thought which have learned the status of *a priori* mental laws, compliance to which guarantees the validity of thought.

4.8 Conclusions

Does it mean that here are only three or four *laws of thought?* The answer is no. Modern logicians criticize the traditional laws of thought by saying that these laws of thought are not exhaustive statements of logical principles. *Principle of Syllogism, Principle of Simplification and Principle of Double Negation* have an equal claim with three traditional laws or belong to the group of fundamental laws of thought.

4.9 Summary

Dear Students, it will be an interesting fact to learn that the laws of thought you have studied in this chapter are the basis of every instance of our reasoning. These laws help you to frame true propositions, identity contradictory propositions, wean out inconsistency from your arguments. These laws have been accepted as the necessary and sufficient conditions for valid thinking. These laws, being the most fundamental laws need no further laws as their basis. Logic seeks to study the proof of validity with the help of these Fundamental Laws of thought.

4.10 Glossary

- **Laws of Identity-** They are the most fundamental laws namely-Law of Identity, Law of Contradiction or Law of Excluded Middle, which are at the root of all kinds of reasoning. <u>They are also called tautologies.</u>

- **Law of Identity-** The first law of thought which states – "A is A" or in other words "Everything is identical with itself only."

- **Law of Contradiction-** The second law of thought which states that two contradictory terms cannot both be true. It is stated as A cannot both B. Also known as law of Non Contradiction.

- **Law of Excluded Middle-** The law of thought which states that two contradictory terms cannot both be true. It is stated as "A s either B or not B". In a way it is asserted that between B or not B middle is excluded.

4.11 Model Questions

1. State and Explain all the three fundamental Laws of thought.

2. State the Law of Identity and Discuss its significance.

Check your Progress	
1)	State the essence of law of Identity
2)	What is the significance of laws of thought.

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Lesson-5

ARGUMENTS : IMMEDIATE & MEDICATE INFERENCE

Structure

5.0 Objectives

After reading this lesson you will be able to:

- Understand what is an Argument.
- Explain the components as well as different type of Arguments.
- Analyse the concepts of validity and Truth.

5.1 Introduction

Reasoning is human mind's one of the finest skills. Though we are born with this capacity but subject like Logic renders us immense help in mastering this skills. We express our reasoning through well-formed Arguments, Obviously learning more about Arguments and different forms of Arguments will help you in this Endeavour. This lesson will not only introduce you to the concept of Argument, it will also give you a detailed account of Immediate as well as Mediate Inference.

5.2 What is an Argument

An argument is a group of statements in which one, the conclusion, is claimed to follow from others. For instance :-

1. *If everything is caused then no one acts freely.*
2. *Everything is caused*
3. *∴ No one acts freely*

Statement 1 and 2 are, the reasons given for concluding 3 and such statements are called premises and statement 3 is the conclusion which follows. Thus, every argument consists of a conclusion and at least one more premise from which the conclusion is claimed to follow.

In every argument one or more premises and a conclusion are asserted. But not every assertion of several propositions constitutes an argument Newspapers, magazines and history books abound in assertions, though they tend to contain relatively few arguments. In order to express an argument assertion is a necessary condition, but is a not sufficient. This necessary condition distinguishes arguments from several kinds of non-arguments with which they are sometimes confused e.g., *If art is symbolic then it expresses emotions.* Such a proposition is called a conditional. Its components propositions, *'art is symbolic'* is not asserted nor is its other component "they express emotional" it asserts only that the former implies the latter, but both could be false, for the statement in question asserts. No premise is asserted, no inference is made, no conclusion is claimed to be true, there is no argument here. But take the following examples: *Because it is symbolic they expressive emotions.* The proposition, *art is symbolic* is asserted as premise are the proposition *""they are expressive of emotions"* is claimed to follow from that premise and is therefore asserted to be true. A conditional may look like an arguments, but is not an argument and the two re should not be confused.

Inference or *Reasoning is the process of passing from one or more propositions to another which is justified by them, and the product is called an inference or a reasoning.* An Inference, thus requires more than one proposition and when expressed in Language it is called an argument. Thus an argument consists of more than one proposition.

5.3 Components of an Arguments

In an argument, we thus proceed from one or more propositions which are given to another proposition. The proposition or propositions which are given me called the premises, and the proposition which is drawn from them, is called the conclusion. Thus in an inference or an Argument from certain given proposition or propositions, we pass on to a certain other proposition which in new to us, though the new proposition follows from the given premises e.g.

(i) All human being, are mortal
(ii) The child is a human being.
} Premises

(iii) ∴ The child is mortal. Conclusion.

5.4 Different types of Arguments

Arguments are divided into two different types-Deductive and Inductive arguments, A deductive argument is said to be sound when the premises of the argument are true and the argument is valid. Saying that the argument is valid equivalent to saying that it is logically impossible that the premises of the argument are true and the conclusion false or in other words in a valid argument if the promises are true, then the conclusion must be true, for e.g.

i. If the snow is white, then it is not black

ii. The snow is white

iii. ∴ It is not black

i. ***If the snow is white,*** *then it is not black and (ii)* ***The snow is white are both*** *true, then it must also be true that (iii)* ***It is not black****.*

As a simple matter of logic it is impossible that premises (i) and (ii) should both be true and the conclusion (iii) be false. It is important to notice the fact, that this argument is valid, does not prove the conclusion is true. Validity is a hypothetical or conditional characteristic, it assures us that the conclusion of the argument is true if the premises are also true. Thus the deductive argument is valid when its premises, if true, do provide conclusive evidence for its conclusion i.e. when premises and conclusions are so related that it is absolutely impossible for the premises to be true unless the conclusion is true also. Every deductive argument is either valid or invalid, the task of deductive logic is to clarify the nature of the relation between premises and the conclusions in valid arguments and thus to allow us to discriminate valid from invalid arguments.

5.4.1 Modes Ponens

The argument may also be said to be valid in virtue of its form. We can say that the above argument by the following symbols : If P then Q e.g. If crows fly then they are birds

P Crows fly

∴ Q They are birds.

This argument form is called *Modus ponens.* Every argument of this form is valid and thus we can say that the argument form itself is valid. Other forms of valid arguments are *Modus. Tollens* i.e

If P then Q

not Q

∴not P

i.e. If it is raining, then it is wet

It is not wet

It is not raining

5.4.2 Dilemma

Either P or Q

not P

∴Q

Either it is raining or it is dry

It is not raining

∴ It is dry

5.4.3 Hypothetical Syllogism :

If, P then Q	e.g. If dogs bark then they bite
If Q then R	If they bite then they are undomesticated
∴ If P then R	∴ If dogs bark then they are undomesticated

5.4.4 Contraposition

If P, then Q

If not Q then not P.

Truth and falsehood may be predicated of propositions, but never of arguments and the properties of validity and invalidity can belong only to deductive arguments, never to proposition. There is a connection between validity or invalidity of an argument and the truth and falsehood of its premises and conclusion but the connection is by no means simple one. Some valid arguments contain only true propositions, for example :

All Men are Mortal

All Kings are Men

∴ All Kings are Mortal

But an argument may Contain a false proposition exclusively and still be valid, for instance.

All Birds can Fly

All Flying creatures have Six legs

∴ All Birds have Six legs

This argument is valid because if its premises were 'true is conclusion would have to be true also even though in fact they are all false. This shows that there are valid arguments with false conclusions, as well as invalid arguments with true conclusions. Hence the truth and falsehood of its conclusion does not determine the validity or invalidity of an argument, nor does the validity of an argument guarantee the truth of its conclusion. There are perfectly valid arguments which have false conclusions. But any such arguments must have one false premise. Arguments of a valid form are valid even if they are completely absurd. e.g.

All Dogs are Cats

All Cates are Monkeys

∴ All Monkeys are Dogs

This argument has false premises and a false conclusion. This brings out the hypothetical character of validity. What is the validity of these arguments amounts to it is that it assures that the conclusion must be true if the premises are true.

5.5 Validity and Truth

If the argument is valid and yet has a false conclusion, what good is validity? Why should we be concerned with validity at all? The answer is that a valid argument is truth preserving. Truth in the premises of a valid argument is preserved in the conclusion. If the premises are not true to begin with, then even a valid argument cannot ensure that the conclusion is true. But at as only valid arguments that are truth preserving. The logician is not so much interested in the truth or falsehood of proposition as in the logical relations between them whereby the logical relations between propositions we mean these which determine the correctness or incorrectness arguments in which they occur. Determining the correctness or the incorrectness of the argument is the job of logic. The logicians are interested in the correctness even of the arguments where premises have be false.

In order to talk about the valid claims we must make a distinction between the validity of an argument and the truth of its conclusion. These are not the same not all valid arguments yield true conclusion and not all arguments that valid true conclusions are valid, for e.g.

Some Philosophers are Platonists

Some Mathematicians are Philosophers

∴ **Some Mathematicians are Platonists**

There could be valid argument with a false premise. The question of the validity of an argument is therefore separate from that of the truth or falsity of its premises and conclusion. To say that an argument is valid is to say that *its conclusion is a logical consequences of its premises, which is in turn to say simply that is the premises are true the conclusion must also be true.* No claim is made with respect to the actual truth or falsity of any premises or conclusion, however, if the argument is valid then it cannot be the case that the premises are all true and the conclusion, is false.

It is useful if we use the term "Sound" to refer to arguments that are both valid and contain true premises. Thus sound arguments satisfy two conditions :

(a) they are valid and

(b) They proceed from true premises.

Since the logic consequences of true premises must be true, sound arguments necessarily have true conclusions, e.g.

All Human beings are Mortal

All Indians are Human beings

∴ **All Indians are Mortal**

In formulating its theory of inference, logic considers arguments only with respect to their form, not with their content. It regards the validity of arguments as being independent not only of the truth or falsity of their premises and conclusions but likewise of their premises and conclusion but likewise of their infinitely varied subject matter. Validity is understood as formal validity and the conditions of valid inference as formal conditions of valid inference.

Logic confines itself to these arguments whose validity rests only on the logical form of the statements compassing them and which may therefore be taken to having a valid argument forms e.g.

It is raining or the sun is shining

It is not raining

∴ The sun is shining.

5.6 Inductive Arguments

There are some a *posterori* statements that are not conclusively falsifiable or verifiable by any possible observations. If such statements are known to be true or known to be false, the evidence of observation on which this knowledge is based does not entail. Such evidence is called inductive and the inference from evidence to conclusion is also inductive.

Inference that is inductive should be distinguished from inference that is deductive the premises of an inductive argument are evidence for the conclusion or hypothesis, but unlike sound deductive argument in which the premises entail the conclusion, the evidence of a sound inductive argument does not entail the conclusion. The evidence supports/justities/confirms or makes probable the conclusion of the argument without entailing it. Thus, it is logically possible that the conclusion of an inductive argument should be false even though the premises are true and constitute. Adequate inductive evidence for the conclusion or in other words we can say that not all arguments are intended to be deductive. A great many arguments do not pretend to demonstrate the truth of their conclusions following necessarily from their premises but merely to establish them as probable or probable true. Arguments of this type are usually called inductive. These inductive are known as argument by analogy. For example, most of our everyday inferences are by analogy. Suppose I read a certain book written by a certain author and I happen to like it, from this I infer that since I have always enjoyed are liked the books of this author I will also like the next which I read. Analogy is at the basis of most of our ordinary reasoning from past experience to what the future will hold.

Inductive arguments are not certain or demonstratively valid like the deductive arguments, for their conclusions do not follow with "logical necessary" i.e. the conclusion do not necessarily follow from the premises. Just it is possible that after reading and enjoying so many books of a certain author, I may not enjoy the next book written, by him. So no argument by analogy has mathematical certainty. Analogical arguments are not to be classified as either valid or invalid. Probability is all that we can say of them. To evaluate the analogical arguments,' one must have some knowledge of casual connections They, are discovered only empirically, by observation and experiment. For example, Universal statements like all crows are black, if accepted are accepted on the basis of inductive evidence because they are not completely verified by observation, and the particular statements, if held to be false, must be so held on the basis of inductive evidence, because they are not falsifiable by observation.

5.7 INFERENCE-MEDIATE AND IMMEDIATE

Out of three forms of thought concepts, judgements and inferences, inference is the most complex and advanced form of human thought. Inference may be defined as a mental process in which a thinker passes from the apprehension of something given, the datum to something, the conclusion, related in a certain way to the datum and accepted only because the datum has been accepted. The datum may be a sense datum, a complex perceptual situation or a proposition. We might define inference shortly by saying that inference is the mental process, in which a thicker passes front one or more propositions to some other proposition connected with the former in a certain way.

It is important to make a distinction between inference and other mental processes that are sometimes confused with it, e.g., a man walking along a familiar street recognizes more and

less clearly the various objects he sees. For instance, suppose an Indian is walking in the streets of Delhi and comes across a Yellow colored vehicle moving towards him he at once recognizes that it as a School Bus. Such recognition is immediate. It would be expressed in the judgement. *"That's a School Bus".* Suppose that he were to put his hand in his pocket and feeling an object against his fingers were to think "That is a pen". Here again his recognition would be immediate e.g., in the first case something visually presented was immediately interpreted as being so-and-so, in the, second case something tactually presented was immediately interpreted as being so and so Such immediate judgements are *judgements of perception*. What is visually presented to us is always less than what we correctly say we see. But it does not follow from this fact that when we say, "This is a pen" we are inferring the pen from the tactual *sense-datum,* nor that we are inferring the table from the sense datum when looking at a table, we judge. 'That is a table'. Our ability, to perceive that this is a pen and that is a table is dependent upon our past experience, and on the basis of our past experience we immediately perceive that this is so and so. In such an immediate recognition no inference is involved. There is no passage from datum to conclusion. Recognition is not always immediate for example on stumbling over some obstacle in a dark room, there were an experience that would be properly formulated only in some such judgement as "That must be the dog", then inference is involved.

Inference must also be distinguished from suggestions and recollection. A certain perfume may recall some occasion in the past when that perfume was perceived. A wet roof in the distance may suggest the surface of a pond. The thought of a pond may recall a summer holiday. In these experiences no inference need enter. There may be nothing that could be expressed in the form "This therefore that", to take an example a man lying on a bed occupied by a suggestion to thought suggested partly by his sense experiences of the moment partly by his recollections of past event. This random thinking was not controlled by factors within the reverie itself'. This can be contrasted with a direct thinking in which the man engaged as soon as he was confronted with a situation that presented a problem to be solved. He then begin to connect the apprehended facts with others in a certain definite way, When he was connecting he was inferring.

The structure of any inference contains premises, a conclusion and a logical relation between the premises and the conclusion. The logical transition from the premises to the conclusion is called inference, for instance :

All boys belong to male species

Ram is a boy

∴ Ram belongs to male species

In this example the first two judgements are premises. The judgement "Ram belongs to a male species" is the conclusion. In order to check the truth of the conclusion "Ram belongs to male species". There is no need to resort to immediate experience but the conclusion of 'Ram being' a member of male species can be obtained with absolute certainty by relying on the premises being true and by following the rules of inference. Therefore inference is a form of thought which by observing certain rules to obtain a new judgement, either necessarily or with a certain degree of probability, from one or several judgements.

The process of drawing conclusions from the premises by the rules of deductive inference is called inference. The derivation of corollaries from given premises is a widespread logical operation. Truth of the conclusion depends on the truth of the premises and the validity

of inference. Sometimes in converse inferences false premises or non premises are deliberately used. However these premises have to be given up at a later stage.

Inference may be deductive, inductive or inference by Analogy. The inference may be logically necessary i.e., it can yield true conclusion or probable i.e., it can yield a conclusion which follows from the given premises only with a certain degree of probability. A correctly construed deductive inference implies the necessary procedure of drawing the logical conclusion from the given premises. Deductive inference is one in which the conclusion necessarily follows from the premises which express knowledge with a higher degree of generality, and itself represents an item of knowledge which a lesser degree of generality, for example:

All fish breath through their gills.

All mermaids are fish.

∴ All mermaids breath through their gills.

In this case, the first premise “All fish breathe through their gills” is a universal affirmative judgement and express a greater degree of a generalisation then the conclusion which is also a universal affirmative judgement "All mermaids breathe through "Their gills."

5.8 Conclusion

Inference may be broadly divided into, deductive and Inductive infance. In deductive inference the conclusion cannot be more general than the premise or premises while in Inductive Inferences, the conclusion must be general than the premises. Deductive Inferences are further divided into Mediate Inference and immediate Inference, Immediate inference is a kind of Deductive Inference in which the conclusion follows from only one premise. In immediate Inference the meaning of a single proposition is made explicit. Since it is a sub-division of the deductive inference the conclusion cannot be more general than the premises, For instance :

No Men are Dishonest

No Dishonest beings are Men

Conversion, Obversion, Inversion and, contraposition are some other forms of immediate inference. In the case of Mediate inference the conclusion follows from more than one proposition i.e., where there are only two premises and the conclusion follows from them jointly. The finest example of Mediate Inference is Syllogism. In Syllogism form of Inference the conclusion cannot be more general than the premises e.g.

All Men are Mortal

All Kings are Men

∴All Kings are Mortal

There the conclusion “All Kings are Mortal" is less general than the premises "All men are mortal.”

5.9 Summary

We began by learning that an argument is a group of statements of which one is claimed to follow from the others. Then we learnt what are the components of an argument and what is the role of and significance of validity and truth in reasoning. Then we were introduced to

different form of argument – Inductive argument we learnt that inductive argument do not offer absolutely valid arguments. Inductive Arguments, are not demonstratively valid like deduction, they are at best sound. Later we examined how mediate and Immediate inferences are distinct. In the following lesson we learn more about Immediate inference, mediate inference and inductive inference.

5.11 Model Questions

1. What do you understand by an Argument? What is significance of Validity in an argument.
2. State and differentiate Mediate and Immediate Form of Arguments.

Self Check Questions

1. What is an Argument?
2. What do you understand by premise?
3. How mediate inference is different from Immediate Inference?

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Lesson-6

KINDS OF IMMEDIATE INFERENCE

Structure

6.0 Objectives

After reading this lesson you will be able to:

- Comprehend Immediate Inference and its kinds.
- Demonstrate how Immediate Inference is drawn.
- Learn to apply the rules of Immediate Inference.

6.1 Introduction

Through Inference we proceed from known facts to unknown facts. You have earlier learnt that deductive inference is mainly of two major kinds – Immediate Inference and Mediate Inference. In Immediate Inference we arrive at the conclusion from just one single premise. Like when from the Truth of an A proposition we derive the falsity of O than it is an instance of immediate inference. This lesson gives you a comprehensive understanding of Inference. Immediate Inference and for major forms of Immediate Inference – Obversion, Inversion, Conversion and Contraposition. A complete understanding of these rules will help you draw immediate conclusion from given premise is your day to day life.

6.2 Language and Logic

Logic and language are two very useful but very complicated tools employed by human beings. It would be obvious from the meaning of the root Logos, from which the name of the discipline. Logic has been derived, that Logic has a very close relationship with language. Etymologically Logic has been defined as a science of thought as expressed in language. Logic employs language for its expression and as a formal discipline it helps language in understanding its formal aspects in a better way. Together they serve as a powerful tool in

communicating our thoughts. But there are certain areas where the role of each discipline needs more serious deliberation especially when they are employed together.

Consider the following sentences :

It is raining	-	(English)
Il' pleut	-	(French)
Es regnet	-	(German)
Ok"kkZ gks jgh gS	-	(Hindi)
ਵਰਖਾ ਹੋ ਰਹੀ	-	(Punjabi)

In all we have five sentences, each in its different expression and distinct from sounds different but all of them convey only one meaning. Not only they convey the same meaning they assert the same very fact also. In other words we can say that they are just different verbal statements representing one fact it is raining. You may consider another example where you can have two different sentences of the same languages, carrying the same meaning but expressed in different ways, like:

i. Some Teachers are Scholars .

ii. Some Scholars are Teachers.

Consider one more pair of sentences.

All green vegetables are nutritious food.

No green vegetables are non-nutritious food.

They sound so different at the first glance, but on a closer look we find, that both these sentences assert the same fact. In our daily discourses we come across several such examples when we have propositions whose verbal statements can substitute each other without affecting the meaning or the validity of the argument in which they are involved. Equivalent propositions could be inferred, one from the Other. *All S is P* is equivalent to *No S is non P or 'Some S is P' will be equivalent to some S is not non P'.* We can say, that the second propositions can be inferred from the first proposition. All these could be said as the instances of immediate inference.

6.3 Immediate Inference

An immediate inference yields a conclusion from a single proposition without any mediation. Why we say that *All S is P is equivalent to No S is non P* we can easily say, *No S is Non P* could be inferred from *All S is P* immediately. In such an inference we have to ensure that the original proposition and the inferred proposition should have the same predicate and same subject. Besides we have to ensure it further that the inferred proposition should not imply more than the original proposition. It is, however, legitimate if the inferred proposition asserts less than the original proposition. For example, from the truth of all *S is P* we can *infere* the *truth of Some P is S.* But it can nor be vice versa.

Before we proceed any further let us understand what is a "contradictory Term". In our day today discourse we understand an object in terms of some positive qualities it posses. For us an object is an object because of these positive qualities and also because of innumerable

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* Logos : Greek root from which she word 'Logic' has been derived, meaning *'Thought'* and *'Speech'.*

characteristics which it does not possesses. If we can understand an object in terms of its positive qualities it possesses, can't we refer to the object in the light of certain characteristics which it does not possess? Obviously yes. Two terms, one representing the possession of certain characteristics and one representing the absence of certain characteristics from a pair of two contradictory terms. These two terms are mutually exclusive But together both the terms exhaust that wider class to which they belong. Take for example the term “Intelligent" or “Non intelligent". Remember the third law of thought – The law of Excluded Middle, which states A is either B or not B. (A man is either *‘intelligent' or non intelligent).* Contradictory terms cannot be false or true at the same time of an individual object. A man is either intelligent or unintelligent. Either *'Man is intelligent'* will be true or *'Man is unintelligent' will be true’*. Remember both cannot be true together and both cannot be *false together.*

In a pair of contradictory terms, say *‘intelligent’* and *'Non intelligent’* we have one positive term (intelligent) indicating the presence of certain characteristics and the other a negative term (non-intelligent) representing the absence of certain characteristics. In our day to day course we do not bother whether we are using. 'Not' or "non' or 'Un' or “Im’ as a prefix to the affirmative term so that the term becomes a negative term, for example perfect/imperfect, likely/unlikely, Good/Non good and True/Untrue Logicians, however, are more careful in these matters. They use only 'Non' as a prefix to the original term so that when any positive and negative terms are employed together every possibility or predication in fully exhausted. But this must be kept in mind that as an independent term *'Non intelligent'* is going to have positive characteristics in its own way. Like when we use a term, say, *'Non Resident Indian'* we do not expect that the term is negative in all respects. Yes, it is negative because we have its counterpart *'Resident Indian'* as a positive term. If you analyze it you will realism that we could have called a *'Non ‘Resident Indian'* as an *'Emigrant India’* also. In that case, apparently it would not have sounded like a negative term. We can have another contradictory term if we treat *'Emigrant Indian'* as a positive term, then, *'Non Emigrant Indian'* will become a negative term. Whatever we presume we have to keep one thing in mind that two terms *S and : Non S. Intelligent and Non intelligent 'Resident Indian,* and *'Non Resident Indian'* will always form a pair of contradictory terms. The simplest way to depict a negative term is to put a bar (--) on the top of the symbol. Like Non S could be indicated by writing S. S win be a positive term, S will be a negative term and both as a pair win called two contradictory terms. S can have an affirmative relationship with P - like. *Some S* is *P.* I can have a negative- relationship with P like *'Some S is not P.* The same could be true of P.

Together S and P a subject and predicate, may have eight possible forms of mutual relationships.

1. S is P
2. P is S
3. S is P
4. P is S
5. S is P
6. P is S
7. S is P
8. P is S

The logical deduction of one proposition from another or equivalence of one proposition to another would be based on these eight forms of relationships. Presently we will study the

following forms of immediate inferences. (*i) Obversion (ii) Conversion (iii) Contraposition and (iv) Inversion.*

6.4 Obversion

Obversion is a form of an immediate inference in which an equivalent proposition is obtained by changing the quality of the original proposition and by substituting its predicate with its contradictory predicate e.g. the obverse of SAP will SE P. *All S is P (SAP)* will be logically equivalent to its obverse *'No S is non P' (SEP)* and both the propositions despite their differences would mean the same. The principle underlying this kind of inference is called *'Double negation' i*.e. two negatives yield and affirmative. Carefully consider the following two propositions:

All saints are pious persons.

No saints are non pious persons

Do you see that these propositions, mean the same ? The first proposition i.e. the original proposition is called an *Obvertend* and the second proposition, the obverted form, is called an *'Obverse'*. An obverse of a proposition is obtained when we change the quality of the proposition and replace the original predicate term with its contradictory term i.e. P. The example we considered above is an example of a Universal affirmative proposition. We will now illustrate what happens to E, I and O propositions when we try to obvert them.

Obversion of E

Obvertend	**Obverse**
No Sinner is a patriot (SEP)	**All Sinners are non-patriots (SAP)**
Some sailers are pirates (SIP)	**Some sailers are non-pirates (SOP)**

Obversion of O

Obvertend	**Obverse**
Some seashells are not pretty (SOP)	**Some seashells are nonpretty (SIP)**

Rules of Obversion

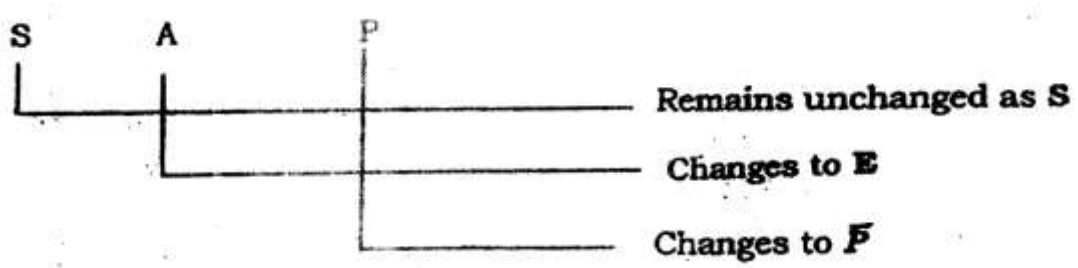
i. Subject term of the obvertend remains unchanged.

ii. Quality of the original proposition and its obverse are exactly opposite i.e. A becomes E, I becomes O and vice versa.

iii. Original predicate P becomes Non P.

iv. No change takes place in the quantity of the obvertend proposition. A universal proposition (say A) remains a universal proposition (say E) and a particular proposition (say I) remains a particular proposition (say O).

Obvertend **Obverse**



SAP..... When obverted becomes.....SEP

6.5 Conversion

Conversion is a form of an immediate inference in which an equivalent proposition is obtained by transpositioning the subject term in place of its predicate and its predicate in place of its subject. For example conversion of *SEP* will be *PES*, consider:

No Sculptors are Puritans, its converted form will be **No Puritans are Sculptors.** The subject term in the converted proposition is replaced by the predicate of the original proposition and its predicate term is replaced with the subject of the original.

Conversion of A

Conversion of an A proposition SAP would yield PIS. A cannot have its complete converse form because according to the rule of conversion the original proposition should be logically equivalent to its conclusion or conclusion should be logically deductable from its original proposition.

As a universal affirmative A distributes its subject term S only is converse. PAS will not be its equivalent as it would not distribute its new subject i.e. P. Covnerse of SAP as PAS would not be equivalent to SAP. Thus conversion of A would be possible in the form of an I (by limitation) only.

Conversion of E

SEP will be logically equivalent to PES. Both the terms in both there propositions are distributed and their transpositioning will be permissible.

SEP No vegetarian is a violent person.

PES No violent person is a vegetarian

SEP when converted becomes PES.

Conversion of O

Conversion of O is not logically allowed because the pattern of SOP-POS, distribution of the term does not work for the reason that terms of the conclusion is distributed in the conclusion but it is not distributed in the premises. Hence conversion of O is not possible.

$\bar{S}O\bar{P}$

Conversion of I

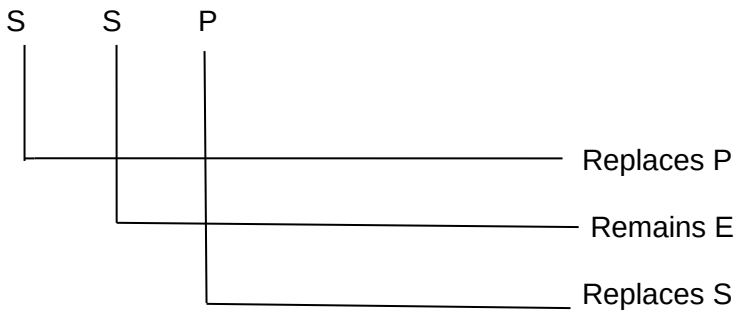
Conversion of an I proposition will be as simple as the conversion of an E proposition, SIP would be logically equivalent to its converse **PIS.** *SIP* = *PIS* since both the terms are undistributed their conversion will not make much of an inference.

Rules of Conversion

i. The subject term of the converted becomes the predicate of the converse.

ii. The predicate of the converted becomes the subject.

iii. Quality of the converted and the converse remains the same.



SEP when converted becomes PES

6.6 Contraposition

Contraposition is a form of an immediate inference in which from a given proposition we infer another proposition having its subject contradictory of the original proposition. It is a compound form of an inference in which we employ both Obversion and Conversion.

In order to obtain the contraposited proposition of **All S is P** we obvert it and get **No S is non P** then we convert the obverted proposition and have *No non P* is S. For example: *All stars are popular will have it contraposited form as* ***No Non popular persons are Stars.***

Contraposition of A :

All soldiers are Patriots (A)

When we begin the process we obvert the universal affirmation proposition.

SAP (All Soldiers are Patriots) yields

$\mathrm{SE\overline{P}}$ (No Soldiers are non Patriots) as a next step we convert this obversion and get $\mathrm{SE\overline{P}}$ (No S is non P) becomes $\mathrm{PE\overline{S}}$ (No non P is S) and finally we obvert this conversion and get $\mathrm{\overline{P}A\overline{S}}$.

Contraposition of I:

Some Animals are Vertebrates. (SIP)

As a first step we obvert the original proposition and get

I - Some animals are not non Vertebrates. (SOP)

Now we are supposed to convert this proposition but as you are aware Conversion of an O proposition is not possible.

Hence valid contraposition of an I proposition cannot be obtained.

Contraposition of E:

No Scholars are Players (E) SEP

As a first step we obvert the original proposition and get- SAP (All scholars are Non Players) and then we convert the obverted proposition. Since the conversion of A is possible only in the form of an I proposition we will get PIS. (by limitation) and then we will obvert this converted proposition to get - SOP.

Ultimately the Contraposition of

No scholars are Players will be

Some non scholars are not non-players.

Since a universal negative proposition yields only a particular negative contraposited we can call it a contraposition by limitation.

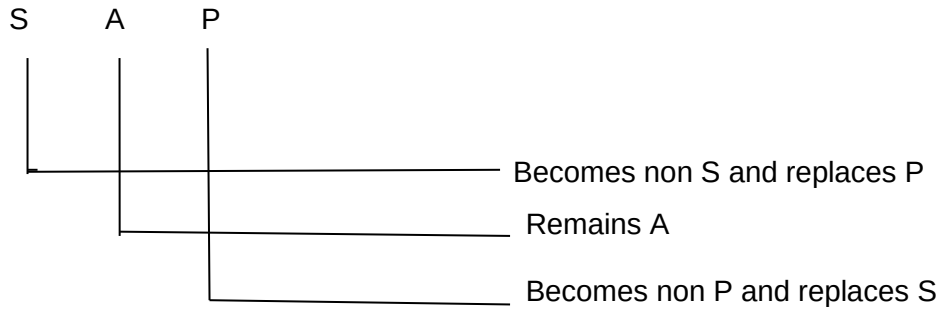
Contraposition of O

<u>Converted</u> **<u>Obverse</u>** **<u>Converse</u>**

Some saints are not philosophers (SOP) -> Some saints are non-philosphers (SIP)-> Some non-philosphers are saints (PIS)

Rules of Contraposition

1. The subject of the conclusion is replaced by the contradictory term of the predicate of the original proposition.
2. The predicate of the conclusion is the subject of the original proposition.
3. The quality of the Contraposited propositions changes. An affirmative proposition becomes a negative proposition and vice versa.
4. Only in the case of an improper distribution the quantity of the conclusion changes from universal to particular.



6.7 Inversion

Inversion is a compound form of an immediate inference in which we infer an equivalent proposition from another proposition which is having a subject which is contradictory of subject of the original proposition.

In inversion, one is required to obtain a proposition of the kind ***Non S is /is not non P, or non S is/is not P.*** In order to derive this one has to employ both *'Obversion'* and *'Conversion'*. One after another. Suppose we want to have the inverted form of S-P. Firstly we will obvert the obverted to 'No S is non P'. Then we will convert it and get No non P is S. The process will be repeated once again, and then we will end up with Some non S is non P. (By limitation).

Inversion is of two kinds: ***Complete and Partial.*** In complete inversion, the predicate of the inverse is contradictory of the original predicate whereas in the case of partial, the predicate of the inverse remains unchanged. Inversion, like contraposition is also a compound form and it also employee Obversion and Conversion. These two primary forms of immediate inferences (Obversion and Conversion) are employed according to the need and convenience because our aim is to obtain a proposition having as its subject the Contradictory of the subject of the original

propositions. The decision whether we should apply Conversion first of Obversion depends upon the desired results out initiative yields. Suppose we employ Obversion and then move to Conversion but it fails to yield any positive results, then try the other form in that case.

Inversion of A : Inverted form of all propositions could be obtained as under :

Invertend	**:**	**All S is P**	**SAP**
Obverse	:	No S is non P	SEP
Converse	:	**No non P is S**	**PES**
Obverse	:	**All non P is non S**	**PAS**
Converse	:	**Some non S is non P (Partial Inverse)**	**SIP**
Obverse	:	**Some non S is not P (Partial Inverse)**	**SOP**

Inversion of E

Invertend	:	**No S is P**	**SEP**
Converse	:	**No P is S**	**PES**
Obsvrse	:	**P is non S**	**PIS**
Converse	:	**Some non S is P**	**SIP**
Obverse	:	**Some non S is not P**	**SOP**

Inversion of I

Invertend	:	**Some S is P**	**SIP**
Converse	:	**Some P is S**	**PIS**
Obverse	:	**Some P is non S (Converse not possible)**	**PIS**

Hence inversion of I is not possible

Inversion of O

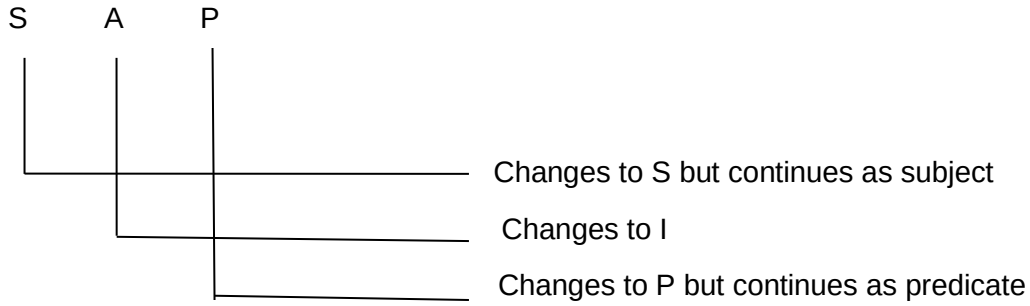
Invertend	:	**Some S is not P**	**SOP**
Obverse	:	**Some S is non P**	**SIP**
Converse	:	**Some non P is S**	**PIS**
Obverse	:	**Some non P is not S**	**POS**

(Conversion not possible)

Hence Inversion of O is not possible

Rules of Inversion:

1. The subject term of the original proposition is contradictory of the subject of the inverted propositions.
2. The quantity of the original proposition (Invertend) always changes from universal to particular.
3. In complete inversion the quality of the invertend proposition remains unchanged whereas in partical inversion the quality is different.



6.8 Quick Reference Table

Immediate Inference

Original Proposition	**Conversion**	**Obversion**	**Contraposition**	**Inversion**
SAP	PIS (by limitation)	SEP	PAS	SIP (by limitation or partial Inverse)
SEP	PES	SAP	POS	SIP
SIP	PIS	SOP	XX	XX
SOP	XX	SIP	POS	XX

S = Non S
P - Non P
XX = Not valid.

Check your progress

1.	Obversion of SEP is	SAP	T/F
2.	Conversion of SAP	PAS	T/F
3.	Inversion of SEP	$\bar{S}O\bar{P}$	T/F

Answers

1	T
2	F
3	T

6.9 Summary

This lesson started by telling that logic and language was two very useful but complicated tools of human beings. After which we understood how sentences are different from propositions. Afterwards we learnt how immediate inferences are drawn, what are contradictory terms.

The lesson bought out a all the four major forms of immediate inferences obsession, conversion, Contraposition and Inversion. You must have learnt that how applying these rules you will able to figure out whether you can draw a valid conclusion from a given premise. These immediate forms of inference will help you improve your argumentative skills.

6.10 Glossary

Obversion – Form of an immediate inference in which from a given proposition another new proposition is inferred whose subject is Contractictory of the subject of the original proposition. If SAP is inverted SOP will be the inverted.

Inversion - A type of immediate inference in which form a given proposition another new proposition is inferred whose subject is Contractictory of the subject of the original proposition. If SAP is inverted SOP will be the inverted.

6.11 Model Questions

Q.1 What do you understand by Immediate Inference? Discuss obversion as an important Immediate Inference

Q.2 What is Conversion. Give all its rules and apply them on A and E propositions.

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Lesson-7

CATEGORICAL SYLLOGISM

Structure

7.0 Objectives

After reading this lesson you will be able to:

- Describe Syllogism as an arrangement
- Explain the rules of Categorical Syllogism
- Recognise and Avoid major fallacies in your arguments

7.1 Introduction

It is very interesting to know that Syllogism, as a form of argument may sound something new to you but the fact is you must have been using this type of argument in your daily life. Literal meaning of Syllogism is Forming together is thought and you will realize in fact syllogism is exactly that. In syllogism we arrive at an unknown conclusion from the premises which are already known to you. It is a very popular deductive mediate form of an argument.

This lesson will unfold the entire world of Syllogism, especially Categorical Syllogism to you where you will begin by learning the key characteristics of syllogism, followed by learning the structure, types, rules and finally major fallacies of syllogism.

7.2 Structure of Syllogism

Syllogism is considered to be one of the most important and most beautiful inventions of human mind. It is probably one of the oldest and the most common tool of Reasoning, however its thread-bare analysis, came much later in the writings of Aristotle. He in his *'Prior Analytic'* defined Syllogism as a "…….discourse in which certain things being posited, something else than what is posited necessarily follows merely from them".

A syllogism is a mediate kind of Deductive Inference in which a confusion is said to follow from two premises having same sort of connection between them. A syllogism consists of three propositions, out of which first two propositions constitute its premises and the third is termed as its conclusion. A premise is a statement in which something is asserted or negated of something and a conclusion is a statement which follows from these statements, Consider :

Premise	**:**	**All Lions are Wild animals**	**--→**	**Major Promise**
		Some Wild animals Fierce animals	**--→**	**Major Premise**
Conclusion :		**Some Fierce animals are Lions.**		

This argument contains three propositions, the first two are called premises, the basis on which the third, (conclusion) is derived. The first premise is normally called a *Major Premise,* and the second premise is called a *Minor Premise*. The subject term of the conclusion forms a part of the Minor premise whereas the predicate terms the conclusion forms the part or the Major premise.

Both the premises contain two terms each and in all the three propositions there are three kinds of terms, each term appearing twice in the syllogism. Major premise contains major term and middle term and Minor Premise contains Minor term and Middle term, whereas the conclusion contain Major term and Minor term. Middle term appears twice in both the premises only and its job is to establish a relationship between two stranger terms - Major and Minor.

Consider :

All Lions are wild animals.

Some wild animals are Fierce Animals..

∴ **Some fierce animals are Lions.**

Here 'Lion' is the major term because it appears as the predicate term of the conclusion and it appear in the major premise. Term Fierce Animal is the minor term because it appears as the subject term of conclusion and it figures in the second premise. 'Wild animal' is the middle term because it mediates between two terms i.e. the major term and the minor term.

A Syllogism has only three propositions containing two terms each, there are only three types of terms Major, Minor and Middle, which appear in three proportions of a syllogism. Middle term is common to bath the premises but it does not appear in the conclusion.

7.3 Syllogistic Argument

Normally major premise comes first and minor premise comes at the second place and conclusion comes at the last place however Aristotle would have no objection even if the minor premise appeared at the first place.

Whenever you come across a syllogism take following steps:

(i) Identify and mark the terms of the syllogism.

(ii) Identify the quantity and quality of the premises and conclusion.

(iii) Formalize the syllogism by replacing the original terms by their symbols and put the quality and quantity determinant *(A E, I or O)* in between.

This is how you are expected to proceed.

Step I	Identify the premises and the conclusion	
	All Saints are Puritans	**Major Premise**
Syllogism	**Some Puritans are Truthful**	**Minor Premise**
	∴ Some Truthful persons are Saints	**Conclusion**
Step II	Specify all the three terms	
	P = Saints	**Major Terms**
	S = Truthful person	**Minor Terms**
	M = Puritan	**Middle Term**
Step III	Substitute the Symbols	
	All P are M	
	Some M are S	
	∴ Some S are P	
Step IV	Indicate the Syllogism in its formal form	
	P A M	
	M I S	**Figure.....IV Mood All**
	∴ S I P	

We can state that Syllogism is a kind of a Mediate-Deductive Inference in which two propositions, known as premises yield a third propositions. The third proposition, known as 'conclusion' in not derivable from either of the premises taken separately. In fact conclusion is derived from both the premises taken together. A Syllogism, thus can be defined as the act of

thought by which from two given propositions we proceed to a third proposition, the truth of which necessarily follows from the truth of the first two premises.

7.4 Rules of Categorical Syllogism

A categorical syllogism can be of various types, depending on the types of propositions and their arrangements in it, and also on the position of the middle term in the premises. However, there are some fundamental rules or, principles to which every categorical syllogism no matter of which sort, should conform in order to be valid. That is, there are some basic rules which even valid categorical syllogism must follow, otherwise the syllogism will be invalid. These rules are of two types :

(i) Quantitative Rules and

(ii) Qualitative Rules

The quantitative rules, obviously concern the quantitative aspects of the propositions and apply to the correct distribution of terms. The qualitative rules concern the qualitative aspect of the propositions used in the syllogism as they fix the role of negative propositions in syllogism.

7.5 Quantitative Rules

7.5.1 Rule I

This rule says that if the middle term of a syllogism is undistributed in both the premises, the argument cannot be valid. The fallacy committed in such an argument is called the fallacy of Undistributed Middle. Consider the Syllogism given below :

All Men are human beings	**P A M**
All Women are human Beings	**S A M**
All Women are men	**S A P**

Here the term *"Human being'* is the middle term and being the predicate of both the affirmative propositions, it is undistributed in both the premises. This argument, therefore, commits the Fallacy of Undistributed Middle.

It is through the middle term that the major and the minor terms are linked together in the conclusion, and the middle term does this job only because (and therefore only when) it refers to same class of entities in both the premises, when its referent in the two premises has not changed. The constancy or the sameness of the referent can be secured only by making at least one occurrence of the term as distributed. An undistributed term refers to only some members of a class, without specifying which members. That is to say, an undistributed term refers to an unspecified sub-class in a class. And two undistributed occurrences of the same term can always refer to two different sub-classes in the same classes, as is actually the case in the above-mentioned example. Since it is a different group of humans who are men than that group or humans who are women. In this example the middle terms cannot validly connect the two terms-men and women. With a middle term undistributed in both the premises, such a possibility is always genuine, and therefore, an argument using such a middle term can never be valid.

Thus, it is a mistake to keep the middle term undistributed in both the premises.

7.5.2 Rule II

This rule says that if a term is not distributed in its premises. It cannot validly be distributed in the conclusion. The rationale of this rule is simple. In a syllogism the conclusion

cannot go beyond the data; that is, conclusion cannot say something about those things which have not been already covered in the premises. Now, if either the major or the minor term is undistributed in its premises it only refers to a subclass of the class. But if the same term is distributed in the conclusion it will be referring to the whole class. Thus, the conclusion will go beyond the data given in the premises making the argument invalid.

The violation of this rule is called the fallacy of *illicit/ major/minor* if the term in question is the major term then the fallacy is called the fallacy of illicit may, if wrong distribution is made with regard to the minor term then it would be an instance of illicit minor. The following arguments commit the fallacy of illicit major.

All Musicians are Sensitive **M A P**

No Politicians are Musicians **S E M**

No Politicians are Sensitive **∴S E P**

An example of the fallacy of illicit minor is found in the following arguments :

All Martyrs are Heroes **P A U**

All Heroes are Great persons **M A S**

All Great persons are Martyrs **∴S E P**

The Minor term *'Great Persons'* is wrongly distributed, in it the conclusion, as it was undistributed in the minor premise, hence the argument is invalid.

7.6 Qualitative Rules

7.6.1 Rule III

This rule says that two negative prepositions do not entail say conclusion. A negative proposition asserts only the exclusion of a class or sub-class from another class. If both the premises of an argument assert nothing more than such exclusion of classes then neither a positive connection not the exclusion, between any two classes can be established.

Consider the following four propositions :

(1) No Philosopher is a Coward.

(2) No Politician is a Philosopher

(3) No Politician is a Coward

(4) Some Politicians are Coward

Now, it is clear that propositions (3) and (4) are contradictory propositions, i.e. these can never be true together. But the proposition (1) and (2) can be true in the situation in which (3) is true and also in the situation in which (4) is true.

As two negative propositions can be true under contradictory situations, no conclusion can be drawn from them. In fact there cannot be a real middle term in two negative propositions.

7.6.2 Rule IV

This rule lays down that only a negative conclusion can be drawn if one of the premises is negative. Let us see how N is really impossible to draw an affirmative conclusion from the combination of affirmative and negative premises.

We know that a negative proposition denies any connection between its two terms. When we come across a negative premise, we in fact establish that there are some instances where the middle term does no include the other term. The conclusion, in any case, is not in a position to establish that there are no instances where, S's are P's. Let us consider the example :

All Dogs are Faithful	**P A M**
Some Faithful beings are not Shy beings	**M O S**
∴ Some Shy beings are not Dogs	**∴ S O P**

Once we have established that M is not connected to S then the conclusion would also show that S is also not connected to P in a positive manner. Thus it is evident that if one of the premises is negative, the conclusion can only be negative.

7.6.3 Rule V

This rule states, if both the premises are affirmative the conclusion has to be affirmative. In such an instance when both the premise are affirmative it means that the middle terms asserts separately connection with both the terms. As a consequence the relationship between both Major and minor is very clearly advocated and any other possibility is ruled out. It is thus evident that from two affirmative premises only an affirmative conclusion comes forth.

7.6.4 Some Corollaries

(i) If one premise is particular the conclusion also must be particular.

(ii) If the major premise is particular, the minor premises must be affirmative.

(iii) From a particular major and a negative minor no conclusion follows.

7.7 Testing of Figures and Moods

A figure of a syllogism means the placement and the position of the middle term and, consequently, that of the major and minor terms, in the syllogism. The figure of a syllogism is determined by the arrangement of the to occurrences of the middle terms. We have seen that the middle term (M) occurs only in the premises, and therefore, there are only four possible patterns of its use in a syllogistic argument: (1) subject of the major premise and predicate of the minor premise, (2) predicate in both the premises; (3) subject in both the premises; (4) predicate of the major premise and the subject of the minor.

These four figures are represented thus :

Figure I	Figure II	Figure III	Figure IV
M - P	P - M	M - P	P - M
S - M	S - M	M - S	M - S
S - P	S - P	S - P	S - P

In the figure drawn above we have suggested an easy way to remember the figures because of their symmetry. As you can well notice that the positioning of middle terms is the syllogism form a slop, which is quite similar to how two tips of our collar of a shirt would appear.

We must-mention here that Aristotle recognized only first three figures, the fourth figure was added later on by Galen, and therefore it is sometimes called Galenian figure.

The 'Mood' of a syllogism means the orderly combination of the types to which the premises and the conclusion of the syllogism belong. For example, the mood of the following Syllogism :

All Geniuses, are Extraordinary	**M A P**	**A**
All Philosophers are Geniuses	**S A M**	**A**
∴ All Philosophers are Extraordinary	**S A P**	**A**

would be AAA because all these propositions are of form 'A' consider another syllogism.

7.7.1 Rule VI

The first minor rule states: *If both the premises are particular no conclusion follows.*

No valid form of syllogism can have two particular premises because it is impossible for a syllogism having particular premises to ensure a definite relationship between its major term and minor term thorough its middle term. Let us consider the four possible combinations of two particular propositions.

i)	**I ---------**	**PIM**	No term is distributed
	I ---------	**SIM**	
		SIP	
ii)	**O --------**	**MOP**	Middle term is distributed
	O ---·----	**SOM**	
		SOP	
iii)	**O --------**	**POM**	Middle term is distributed but fallacy
	I -------	**SIM**	of illicit major is committed
		SOP	
iv)	**I -------**	**PIM**	Middle term is distributed but fallacy
	I -------	**SOM**	of illicit major is committed.
		SOP	

(i) ...is ruled out on ground that in the entire syllogism no term is distributed at all.

(ii) ...is disallowed because both the premises are negative and no conclusion follows from two negative premises (Rule III).

(iii) & (iv) are ruled put because the predicate term of the conclusions, i.e. major terms of the syllogism are distributed in the conclusion but they are not distributed in the premises. Both the syllogisms commit the fallacy of illicit major.

Hence under no circumstances a valid syllogism can have both the premises as particular propositions.

Some flowers do not have smell	**M O P**	**O**
All Flowers are attractive	**M A S**	**A**
∴Some attractive things do not have smell	**S O P**	**O**

Mood

To determine its mood, write the types of which its premises and conclusion belong in the order in which they are given in the syllogism. The major premise is of type O, the minor of type A and the conclusion of type O. Thus the mood will be O A O.

It will be clear that the some moods cannot be valid in other figures also because they may violate the general rules of a syllogism and their corollaries. However we must know that moods beginning with the following pairs will always be invalid and therefore, disallowed in all the figures :

EE,	OO,	EO,	OE,	II,	IO,	OI,	IE
(1),	(2),	(3),	(4),	(5),	(6),	(7),	(8)

The first four combinations of the premises are disallowed by the rule III. The 5th, 6th & 7th combinations are in disallowed by the corollary I, and the last combination invalid due to the corollary III.

Logically, there are only 16 possible combinations of the premises, as only four types of premises (A, E, I, O) are admitted in a syllogism. However, as the above mentioned eight combinations are admissible, only the other combinations are left for making valid moods. These combinations are: AA, AE, AI, AO, EA, EI, IA, QA. But not all of these additional rules besides the general rules of validity and these additional rules further restrict the admissible combinations of the premises such that even out of the remaining eight combinations allowed by the general rules some are disallowed in a figure by its special rules. Thus, in a particular figure only some out of those eight combinations are such that a conclusion could be validly inferred from them.

7.7.2 Four Figures and Their Valid Moods

First Figure - A Syllogism where the middle term is the subject of the major premise and predicate of the minor premise, is said to be an instance of First Figure :

Valid Moods of First Figure

BARBARA CELARENT, DARII &

FERIO

A careful study of various combinations of categorical proposition appearing as premises and conclusion is syllogism reveal that these propositions can combine to form 256 possible moods. You just pause for a moment and look back how many valid moods you can find only 19 valid moods and only 15 of them is the perfect form. Modern logicians accept only 15 valid moods, DARAPTI & FELATON (Illrd figure) and BRAMANTIP and FESAPO (IVth figure) are not entertained as valid moods by modern logicians as they commit the existential fallacy.

On a close look you will notice that AAA mood is valid only in the first figure whereas EIO is a valid mood in all the four figures - FERIO (Ist Figure), FESTINO (IInd Figure), FERISON (Illrd Figure) and FERISON (IVth Figure).

Second Figure : A Syllogism, in which, the middle term comes as predicate of both premises, belongs to Second figure.

P M

<u>S M</u>

∴ **S P**

Valid Moods of Second Figure:

CESARE, CAMESTRES, FESTINO & BAROCO

Third Figure : A Syllogism, in which middle term appears as subject term of both the premises is said to be an example of Third Figure.

M P

M S

∴ **S P**

Valid Moods of Third Figure:

DATISI, DISAMIS, FERISON, BOCARDO, FELAPTON, DARAPTI

Fourth Figure : A Syllogism, wherein the middle term appears as predicate of the major premise and subject of the minor premise, belong to Fourth Figure :-

P M

M S

∴ **S P**

-Valid Moods of Fourth figure:

CAMENES, DIMARIS, FERISON, BRAMANTIP & FESAPO

You may test the validity of the following moods to evaluate your understanding of the basic rules :

Moods	Figures
AAA	IVth Figure
AOO	IIIrd Figure
IEO	IIIrd Figure
OAI	Ist Figure

Have you observed that out of 256 possible moods only 19 (15 + 4) are valid? You must appreciate that a careful study of the rules of Syllogism will help you to identify the valid arguments and spot the fallacy is an invalid argument.

A careful study of the figures and their moods would be of great help in determining the validity of syllogistic arguments.

7.8 Fallacies of Syllogism

In order to understand the rules of correct thinking properly and comprehensively, it is necessary that we also have knowledge of the commonly committed errors. In addition to the knowledge of the tenets of correct reasoning one should also know the pitfalls into which one is likely to fall. A Fallacy is an error in reasoning or in an argument. An argument is said to be fallacious when the mode or the form in which it is done is not in accordance with the rules of logic. There are, of course, no hard and fast rules of thinking erroneously or fallaciously. But by knowing the rules of valid reasoning one can say that and argument, which is in accordance with the rules, is valid or logical and an argument, which does not conform to the tenets of correct thinking is invalid or fallacious.

7.9 Types of Fallacies

Aristotle was the first logician to give a classification of fallacies, and his classification is the most widely accepted classification. Accordingly to this scheme of classification, fallacies are broadly divided into two main groups.

7.9.1 Logical Fallacies

Logical fallacies are the fallacies which occur in the forms of the arguments. These are, thus merely formal fallacies and are independent of the content of the argument. These can be discovered without knowing the content or the subject matter with which the argument is concerned.

7.9.2 Material Fallacies

These fallacies are concerned with the subject matter of the content of the argument. Material fallacies can be found out or set right only by people who are conversant with the content of the argument.

7.10 Types of Logical Fallacies

Presently we will take into account logical fallacies only. Because only logical fallacies interest a logician and only they send themselves to some sort of classification.

Logical fallacies can further be divided into two classes:

(a) **Purely Logical Fallacies :** These fallacies result from distinct breaches of logical rules. Some such logical fallacies are being discussed below.

(b) **Semi-Logical Fallacies :** These arise due to ambiguous and emotive use of languages, Fallacies of Equivocation, amphiboly, accent, figure of speech etc. are some such fallacies.

We shall concentrate only on the purely logical fallacies. These have been defined as the fallacies which violate the rules of logic e.g. rules of syllogism. In order to have a better grasp of the nature of these fallacies, it is necessary that you must know the rules of valid or correct syllogistic thinking.

The rules of syllogism give us the exact conditions or circumstances under which propositions can be suffered from two other propositions. These general principles which are common to all valid moods of the syllogistic arguments had already been discussed in our previous lesson. A valid syllogism must conform to all these rules, if it fails to do it, it is considered as a fallacious argument. We shall discuss some commonly committed, purely logical fallacies.

7.10.1 Fallacy of Four Terms (Quaternio Terminorum)

Syllogism consists m comparing two terms by means of a middle term there cannot be less than three terms nor can there be more. This is because there must be two premises and a conclusion because both the constituent terms of the conclusions occur also in the premises, there can only be three terms. The relation between the terms of the conclusion can be established only by establishing their relation to a common third term the middle term; for they themselves occur in a separate premise, a syllogism, thus can have three, and only three terms - neither less or more. A syllogism which has four terms is said to be committing the Fallacy of Four Terms of The Fallacy of QUATERNIO TERMINORUM.

We cannot draw any conclusion from the premises ‘What breathes needs oxygen’. *‘Fish have gills'.* Another premise ‘What has gills breaths’ is required in order to draw an inference

from the two. The whole argument which has four terms, can be split into two separate syllogism with three terms each.

(i) What breathes needs oxygen;

What has gills breathes.

∴ What has gills needs oxygen.

(ii) What has gills needs oxygen,

Fish has Gills.

∴ Fish needs oxygen

Fallacy of four terms also occurs when the middle term is used equivocally or ambiguously. Then this fallacy is called Fallacy of Ambiguous Middle. A term is said to be used ambiguously or equivocally when it is used in different senses in the same argument, let us take the following examples :

Pests are insects -

Babu is a pest,

∴ Baba is an insect

Here the meaning of the term 'pest' is shifted in one direction to connect it with the minor term and in another direction to connect it with the major term. Thus the word 'pest' connects the two terms of the conclusion with two different terms. So the relationship asserted by the conclusion is not established by the premises. This fallacy is sometimes called the Fallacy of Ambiguous Middle, but generally it is referred to as the Fallacy of Four Terms, since the meaning of one of the other terms; rather than of the middle term, may be shifted. This would involve the same error.

One should be careful in identifying the terms. It is quite possible that the middle term really may be the same, though in different words, in the two premises.

Warriors are patriots.

Arjun was a fighter

∴ Arjun was a patriot,

In this case the syllogism is having three and not four terms as 'fighter' and warrior mean the same.

7.10.2 Fallacy of Undistributed Middle

The premises of a syllogism justify asserting the connection between the two terms of its conclusion only if they assert that each of the two terms is connected with a third-term in such a way that the first two are appropriately connected with each other through or by means of the third. And to fulfill this requirement, at least one of the two terms of the conclusion must be related to the whole of the class designated by the third or middle term. Otherwise, it is quite possible that each may be connected to different parts of the third and may not be connected to each other at all. This is the case with the following example :

All Males are bright

All females are bright

All males are females

The conclusion does not follow validity from the premises. The middle term 'bright' is not distributed in any of the two premises. This argument is committing the Fallacy of Undistributed Middle. A term is distributed in a proposition when the proposition refers to all members of the class designated by that. Affirmative propositions do not distribute their predicates, because there is no reference to the whole class of the predicate term. But universal propositions distribute their subjects as the predicate is attributed to all the members of the subject class. Similarly, negative propositions distribute their predicates. E propositions distribute both, I proposition distribute none, and O propositions distribute their predicates.

7.10.3 Fallacy of the Illicit Process of the Major Term and the Minor Term

In a valid standard form of categorical syllogism no term could be distributed in the conclusion which is not distributed in the premises. A breach of this rule is called the FALLACY OF 'THE IILICIT PROCESS OF THE MAJOR TERM ON MINOR TERM. The sole subject of a syllogism is to prove the conclusion only on the basis of what the premises have to say or assert. We cannot go beyond what they assert and if we do we argue erroneously. If a term is not distributed in the premise but is distributed in the conclusion then the conclusion is referring to whole of the class referred by that term, whereas the premise does not do so. Thus the conclusion asserts much more than is warranted by the premise the conclusion is illegitimately going beyond what is asserted by the premise. It is an illicit process for the conclusion to do so. If the miner term is undistributed in the premise and distributed in the conclusion then the FALLACY is of the ILLICIT PROCESS OF THE MINOR TERM OR ILLICIT MINOR, e.g.

All Brahmins are Indian.

All Brahmins are Vegetarians

All Indians are Vegetarians.

If it is the case that major terms is distributed in the conclusion but is undistributed in the premise, the Fallacy is of illicit process of the major or illicit Major e.g.

All Honest people are Men,

No Politician is Honest

∴ No Politician is a Man.

7.10.4 Fallacy of Exclusive Premises

It is not possible to draw any conclusion from two negative premises. A negative promise (E or O) denies class inclusion. It asserts that all or some of one class is excluded from the whole of the other class. If both the premises in an argument are negative, then the major premise would deny any connection between, the major term and the middle term and the minor premise would deny any relation between the minor term and the middle term. If the major and the minor terms are both denied to stand in that relation to the middle term, we cannot tell whether or not they are related to each other as subject and predicated. We cannot do this on the basis of what the premises assert. And if we do it, we commit the Fallacy of exclusive premises or Negative premises.

For example :

Indians are not Europeans,

Asians are not Europeans

∴ **Indians are Asians**

The conclusion seems to be right on the basis of our knowledge about social facts but our premises do not warrant it.

7.10.5 Fallacy of Drawing an Affirmative Conclusion from a Negative Premise

If any one of the two premises of the syllogism is negative the conclusion must be negative; and if the conclusion is negative, then one of the premises must he negative. If either of the premises is negative, then it is denying the class inclusion, i.e., it is denying the relation of one term to middle term in order to have an affirmative conclusion both the premises must be affirmative - both must assert class inclusion. If one of the premises is negative and the conclusion is affirmative, then the fallacy committed is that of Drawing An Affirmative - Conclusion from a Negative premise. Similarly if both premises are affirmative and if they justify a conclusion at all, they must establish and not refute the relation between the major and minor.

7.10.6 Fallacy of Particular Premises

Fallacy of Particular Premises is committed when a conclusion is - drawn from two particular premises. We can draw no conclusion from two particular premises I and O are the only two particular proposition, and each of term may be either the major premise or the minor premise. Four combinations are possible - OO, II, OI and IO. No conclusion can be inferred from OO propositions, because both are negative premise (Rule V) In II no. term is distributed, hence no syllogism, is possible. In IO and OI only one term is distributed, i.e., the predicate term of O proposition. If it is not middle term, then rule 13 is broken; and if it is the middle term, then either of the other terms is distributed. But the conclusion must be negative (Rule VI), and therefore its predicate (the major term) is distributed, which is not distributed in the premises (Rule IV).

Thus, this fallacy can be reduced to the Fallacy of Undistributed Middle and the Fallacy of the Illicit process of the Major term. An example of this fallacy is :

Some Children are playing

Some Children are hungry

∴ **Some hungry Children are playing.**

7.10.7 Fallacy of Drawing a Universal Conclusion from a Particular Premise

If one keeps in mind the-six basic rules of valid syllogistic arguments, then one can see that a universal conclusion cannot be drawn from a particular premise. AI and IA, AO and OA, El and IE, EO and OE are eight possible combinations of one particular premise and one universal premise. No conclusion is possible from EO and OE propositions (Rule V). In Al and IA, only one term is distributed in its premise and this must be the middle term (Rule V). Therefore, in conclusion no term can be distributed, which can happen only in a particular proposition viz. I proposition. In AO and OA, and El and IE, two terms are distributed the subject of A proposition and the predicate of O proposition, or the subject and predicate of E proposition. One of these two distributed terms must be the middle term (Rule III), hence only one of the terms S and P can be distributed the premises. Now since one premise is negative, the conclusion is negative (Rule VI); therefore, P its predicate is distributed; in the case S (its subject) cannot be distributed. Therefore, the conclusion must be particular.

Thus, we see that the last two fallacies can be reduced to other fallacies, i.e. fallacies of undistributed middle and illicit process of the major term.

7.11 Summary

After giving through this lesson you will be very confident about your comprehension of categorical syllogism as a mediate-deductive argument. You must have carefully learnt all the major rules, be it- Qualitative or Quantitative or even corollaries. Concepts of Figures and Moods will further consolidate your grasp on Syllogism. Toward the end while going through Fallacies you must have taken mote that a thorough mystery on them will help you to enhance your argumentative skills.

7.12 Glossary

Syllogism – Valid Deductive form a mediate argument composed of two premises and one conclusion.

Mood – A way of Classifying different forms of Syllogistic argument on the basis of quantity and quality of all the three constituent propositions of the syllogism.

Figure – A logical form of Syllogism which is decided by the position of middle of a syllogism. There are four figures.

Fallacy – A logical fallacy stand for different kinds of errors or a violations of logical rules in forming an argument. They are common errors, omissions, mistakes which can be typically classified.

7.13 Model Questions

Q1. What is Syllogism. Give the Qualitative rules of Valid Categorical Syllogism.

Q2. State and Explain the Quantitative rules of Pure Categorical Syllogism.

Q3. Write short notes on any two:

(a) Figures
(b) Moods
(c) Fallacy of Undistributed Middle

Check your Progress

1. Identify valid moods in First Figure.

(a) BARBARA

(b) DISAMIS

(c) FESAPO

(d) DARII

(e) CELARENT

2. Write True False –

(A) MOODS refer to arrangement of middle terms. (True/False)

(B) Middle Term appears in Conclusion. (True/False)

Answers

1. a, d, e.
2. (a) T

(b) F

Lesson - 8

INTRODUCTION TO TRUTH TABLES

Structure

8.0 Objectives

After reading this lesson you will be able to:

- State and define Symbolic Logic
- Explain Truth and Truth Tables
- Precisely comprehend different forms of Truth Functions

8.1 Introduction

In the previous lessons you had been introduced the classical, mostly Aristotlien logic. This lesson introduces you the next level of logic. Symbolic Logic, Obviously this is a much later development and one could better call it Modern Logic. Symbolic Logic is in pack a refined and more refined form of traditional logic. Logiticians like Frege, Peans, Tarski, Boole, Carney, Whitehead and Russell have made significant contributions in its development.

Another important point we will learn concerns validity of the argument and argument forms. At this tell you that validity is symbolic logic is a like different from the idea of validity is

Aristotlian Logic which you so far have died. The concept of ‘Logical Entailment’ will be interesting to lesson.

Logic is defined as a normative science of correct inference. It means that it is a science which gives us knowledge of the principles and methods with which we can distinguish between correct and incorrect inference.

It is believed that the famous Greek philosopher Aristotle discovered the fundamental rules of correct inference in the 4th century B.C. That is why in the western world he is also known as the "Father of Logic". Aristotle has discussed Logic at two levels. At the first level Logic is seen as an instrument with which correct inference can be separated from incorrect ones, and at the next, the rules and methods of Logic themselves are made the object of study. Ordinarily when Logic is defined as the normative science of correct inference, it is deemed only as a instrument for helping us to infer correctly in various branches of knowledge. It is a one-sided view. It is only when we pay attention to the other level of the subject, its nature as a theoretical science is disclosed before us, and we can understand it in totality.

8.2 Symbolic Logic

Symbolic Logic which is in fact a refined and an advanced form of Aristotelean Logic, is developed by mathematicians like-Frege, Peano, Tarski and Boole and philosophers of science like-Carnap, Whitehead and Russell. The use of symbols to a limited extent can be seen in Aristotalian Logic itself. In fact Aristotle's procedure to explain arguments by presenting them in specific figures was the first step towards the development of Logic in symbolic form which constantly moving forward has reached the present form which is completely a symbolic science. So it would not be wrong to say that logic is basically symbolic by its very nature. But it would be desirable and necessary to understand those reasons due to which logic developed in its present form.

(A) We know that inference is a mental process which is called an *Argument* when explicitly presented through a language. An argument is formed by propositions. Propositions, if presented in natural language might suffer from ambiguity and vagueness due to the ambiguity and vagueness present in its words. Thus the conclusion of the argument may go wrong. It can be explained with the help of an example :

***Major Premises* - All pages are under paid workers.**

***Minor Premises* - We can write on a page.**

***Conclusion* - We can write on a under paid worker.**

Obviously, the conclusion is meaningless and false. Such a mistake occurs due to the ambiguity of the word "page". In the first, proposition it means servant and in the second it means a piece of paper. Any natural language is rich and so efficient especially due to the fact that most of its words and phrases express more than one meaning. This feature of natural language enables it to give a beautiful poetic description of human emotions and just a single expression creates many images before our minds eyes. But the same feature of natural language comes in the way of a precise communication of a definite message. The fallacy in the above state in an argument has come due to this reason. To avoid such fallacies we need an artificial language in which the use of every symbol is specified by definitions or definite descriptions. If we use an artificial language where symbol "P" is definitely described as a "servant" then the same cannot be used for the expression "something on which we write" we will have to use some other symbol for it. Thus no middle term will obtain between the given two

propositions. The illusion of a middle term which rises due to the ambiguity of "page" will vanish and no logical fallacy would take place.

(B) There is a very big benefit of using symbolic language which can never be availed with the natural languages. By using symbolic vocabulary we can write down so many propositions in a short space with utmost precision. The facilitates seeing clearly their mutual connections, and reaching at a correct conclusion becomes possible. This task becomes almost impossible or extremely difficult to achieve if the number of propositions given in a natural language is very large. It will become clear by the following example. If it rains adequately then either the farmers will lend their fields to someone else or they will plough their fields. Either they will not plough their fields, or they will sow seeds in them. If they sow seeds in them and the weather remains favourable then there will be good crops. Either there will not be good crops or there will be no famine. But it is not true that either the weather does not remain favourable or it does not rain adequately.

Moreover the farmer will not lend their fields to someone else either. Therefore, there will be no famine.

We can see some relation between the propositions of premise and the conclusion. But to delineate the nature of this connection in order to determine the correctness of the given argument we require too much mental labour. Now, if the same argument is presented in the following form.

A ⊃ (B v C)

~ CvD

(R. D) ⊃ E

~ E v ~ F

~ (~ R v ~ A) /. ~F

Then the connection among the propositions can clearly be delineated and it will be easy to determine whether the conclusion follows from them or not. The study and use of such symbols are the points of our further discussion. The students will be able to understand this symbolic argument on a second reading.

(C) Finally, we can clearly understand why it is necessary to present logic in symbolic form if rules and methods of inference themselves are made the object of our study. At this level we do not think over any specific argument or examples of arguments but try to meditate upon the conditions and limits which are necessary for logically presenting and using the rules and methods of inference.

The only way to do this is to raise them from their applied level to a level where they can be seen as bare forms (like skeleton): This can be done only by transforming statements into sequences of uninterpreted symbols. When this task is accomplished, logic can be seen, as a formal deductive system which operates through purely formal conventions. The study of logic in this form helps us to develop new inference-calculi “Propositional Calculi" developed by Hilbert and Ackermann, Russle and Whitehead **(in Principia Mathematics),** Rosser and others, are the examples of study of logic from this point of view (which form the subject matter of higher studies in logic).

8.3 Truth Function and Truth Table :

The Foundation of Symbolic Logic

In order to study symbolic logic we have to understand first the concept of truth function. This concept has come to logic straight from Mathematics. "Function" is a frequently used word in Mathematics. It goes without saying that this concept is brought in vogue by Mathematician - Logician like Godel, Frege and others, but it is not necessary to have special knowledge of Mathematics to understand this concept.

We can understand, function as a ratio (In Trigonometry also at the elementary level trigonometric ratio is called trigonometric function). Ratio is a comparison of two quantities. Ratio has no value in itself. It depends upon the quantities which are being compared and which themselves are not constant but vary in varying condition. It can better be explained with the help of an example. *Let us suppose that a father is forty years old and his son is of 10 years. So the ratio of the ages of father and son is four is to one. After five years the father's age will be forty and the age of the son will be fifteen. Then the ratio of their ages will be three is to one.* "It is clear from this example that ratio varies with varying quantities which are being compared. The meaning of "function" also can be grasped in this way. *A function is an indeterminate expression which has no value of its own but its value is uniquely determined by assigning values to the expressions on which it depends* (One should not have the confusion that all 'functions' are ratios. It is just the opposite, all ratios are functions of one kind but there can be other types of functions also. In above explanation function is described through the concept of ratio only because this is a common notion with which most of the students are familiar.)

In the light of above discussion it can be said that "truth-function" also is an indeterminate expression which depends upon those expressions whose truth values are not constant, but change in varying situations. To understand the concept of "truth-function" we will have to understand the meaning of "truth value" and "expressions" whose truth value varies.

8.4 Compound Proposition - Truth Function

We have studied about the definition and classifications of proposition in traditional logic. In order to understand the concept of "truth-function" in its applied sense we will try to understand the classification of propositions according to structure. From this point of view propositions are placed in two classes. *(i) Simple and (ii) Compound. A simple proposition is that which cannot be further analysed into other propositions.* They can be analysed only into terms. Simple propositions state simple facts, e.g. "Ram is a student", "This is a book" etc.

A compound proposition is formed by the combination of more than one simple propositions. The truth/falsity of compound composition is determined by the truth/falsity of constituent simple propositions and the nature of their combination. For example.

"Ram and Shyam live in the same room - À of the hostel" is a compound proposition which is formed by two simple propositions "Ram lives in room - *A of the hostel" And "Shyam lives in room - A of the hostel."* The compound proposition will be true only if both the simple propositions are true. It will be false if either of them is false. Compound propositions are of the following types.

8.5 Conjunction

The above stated compound proposition is neither true nor false in itself. It has no truth value (i.e. truth/falsity) of its own. Its truth value is determined by the truth values of the simple proposition from which it is formed. The truth values of the constituent simple propositions are not constant; they vary with varying conditions. In one situation they may be true, in another they may be false. Since the truth values of simple propositions vary therefore these propositions are called "variables" for the compound propositions which is formed by them. With varying truth values of simple propositions the truth value of the compound proposition also

varies. Let us consider this point with regard to the above stated example. If the simple propositions – *"Ram lives in room of the hostel"* is true but another simple proposition – *"Shyam lives in room – A of the hostel"* is false then the compound proposition – *"Ram and Shyam live in the same room* –A of the hostel" will be false. If, on the other hand "Ram lives in room-A of The hostel – is false but "Shyam lives in room – A of the hostel" – is true, then also the aforesaid compound proposition will be, false. Again if both the constituent simple propositions are false then the compound proposition is false again. It will be true only when both the simple propositions are independently true. It means to say, that the truth value of the compound proposition is uniquely determined by the truth values of simple, propositions. So the compound proposition will be called the *'truth function" of the simple propositions.*

If the simple propositions are presented independently each by letter "p" and "q" respectively instead of being written in the form of two full sentences of English (i.e. "Ram lives in the room – A of the Hostel" is symbolically presented by "p" and "Shyam lives in room A of the hostel", by "Q" and the joining connective word "and is symbolized by "." then the complete compound proposition "Ram lives in room-A of the hostel and Shyam also lives in room-A of the hoses (which is presented as "Ram and Shyam both live in the same room-A of the hostel can be symbolically presented merely as "p.g." a part from saving the time, space and labour in presenting the compound proposition, this presentation includes all the characteristic features which we have mentioned in the beginning.

Once the above stated proposition is transformed into symbols, it can easily be shown that T is a truth-function of propositions "p" and "q". Following truth table shows that clearly:

p	q	p . q
T	T	T
T	F	F
F	T	F
F	F	F

TABLE - 1

("T" for Truth and "F" for False)

Aforesaid compound proposition is formed by the conjunction of two simple propositions. Connective "And" is the mark of conjunction. So the above presented truth table represents the conjunctive truth function. It stands not only for the specific compound proposition we took for example, but it represents all types of conjuctive propositions in general because symbols. "p" and "q" etc. do not stand for the actual content of the proposition but they represent their order and truth functional relations only.

There are only two simple propositions in our aforesaid example or conjunctive proposition. It does not mean that the truth-table presented above represents only those conjunctive propositions which are formed by only two simple propositions. The truth-table is the representative truth-table of conjunctive propositions containing any number of simple proposition as its conjuncts. In every case the conjunctive propositions will be true only if all the conjuncts are true, and will go false if even one single conjunct is false.

There are various types of compound propositions. So there are various types of truth-functions too. Compound sentence found in any natural language can express following types of compound propositions :- *Conjunctive, Disconjunctive, Implicative Equivalent and Negative propositions.* Conjunctive proposition is already discussed above. Now we will study other types of compound propositions as various forms of truth-functions.

8.6 Disjunction

Disjunction is that form of compound proposition in which two or more simple propositions are connected to one another with the connective 'Either.... or' e.g.

Either you read or you enjoy yourself'.

The two simple propositions in this compound proposition are

I. 'You read'

'and'

II. 'You enjoy yourself'.

The above two simple propositions are connected together with the connective 'Either…….. or'. This is a truth-functional connective which means 'at least one is true'. The compound proposition formed with it is disjunction truth-function because given the above meaning its truth-value can be completely determined by the truth-values of the constituent simple propositions. We can easily understand that this compound proposition will be true when :

Both (i) and (ii) are true,

Either of (i) or (ii) is true

and it will be false when

both (i) and (ii) are false

If we symbolize the simple proposition - "You read' with 'p'

You enjoy yourself with 'q'

and, if the logical connective "Either.....or is symbolized with the sign 'v' (wedge) then the compound proposition.

'Either you read or you enjoy yourself,' will by symbolized as 'p v q'.

Given the above meaning of the truth-functional connective 'v' we can easily draw the following truth-table of Disjunctive Propositions :-

p	q	p v q
T	T	T
T	F	T
F	T	T
F	F	F

TABLE - II

The truth table shows that a *disjunctive proposition is false only when both the disjuncts (simple propositions forming the disjunctive proposition) are false. In all other conditions is true.*

8.6.1 Exclusive Sense of Disjunctive Proposition

Often, in our natural languages the Disjunctive Proposition is also used to exclude one alternative from the others (as constracted with the above stated disjunctive proposition that includes both the alternatives). In this use it doesn't mean - atleast one. It means-only one. When we say, You can take either tea or coffee, we mean - *you can take only one of them, not both.* Given this meaning we understand that this Disjunctive proposition will be true when - (i) ‘You take (only) tea (and not coffee)’.

and, (ii) You take (only) coffee (and not tea)' are true.

It will be true even when both the simple propositions – ‘You take tea’. And ‘You take coffee.'- are false (because both can't be taken together but in case one doesn't take either, the stated conditions remains true).

This type of Disjunctive Proposition becomes false only when both the disjuncts are true (because it goes against the stated condition of taking only one.) So the truth-table of the Disjunctive proposition having exclusive sense, like the one stated above, can be drawn as follows:-

p	q	p v q
T	T	F
T	F	T
F	T	T
F	F	T

TABLE – III

Here the constituent simple propositions –‘You take tea -is symbolized' as 'P' and **You take coffee** -is symbolized as 'Q'.

It is important to note that we actually don't need two types of truth-tables to determine the truth-value of two sense of Disjunctive Propositions. It is possible to reformulate the Disjunctive Proposition (discussed earlier) that remains true on the inclusion of both alternatives. Let us see how the present example of exclusive sense Disjunctive Proposition can be so reformulated.

The Compound Proposition - **'Either you take tea or coffee'** – means that one can't take both. This meaning can be fully captured by restating.

'Either you don’t take-tea or don't take coffee.’

This exclusive sense of the proposition is precisely and explicitly stated in this formulation. Now, we can draw the truth-table of this Disjunctive proposition as instructed earlier.

If we are symbolizing the simple proposition –‘You can take tea’ with 'p' and -You can take coffee - with 'q' then ‘You can't take tea’. ‘will be symbolized as 'p' and, ‘You can’t take coffee. 'Will symbolized as 'p' v 'q' and its truth-table can be drawn as follows :-

P	q	~p	~q	~p v ~q
T	T	F	F	F
T	F	F	T	T
F	T	T	F	T
F	F	T	T	T

TABLE - IV

We can see that (Table-IV) and (Table-III) are the same, and (Table- II) also is the same if we see that ~p v~q is false only when ~P and ~Q are false. In all other conditions it is true.

8.7 Negation

Negative proposition such as ‘Ram is not hard working'. -- appears to be a simple proposition. But the fact that the truth of the positive proposition i.e. 'Ram is hard working'- determines the truth of the former proposition, discloses its truth functional nature. If the latter is true, then the former is false, and if the latter is false then the former is true. So negation is also regarded a truth function of the simple proposition given in its positive. Given this understanding we can easily draw the truth table of negative truth function as follows :-

P	~p
T	F
F	T

TABLE - V

Here 'p' stands for any simple proposition (as 'Ram is hard working') and is there logical sign for negation.

8.8 Material Implication

Implication is that form of compound proposition which two or more simple propositions are connected with the connective 'If..... then.’

If it rains then the farmers will go to the fieIds.....is an example of type of compound proposition: it is made up of two simple propositions -

(i) R rains

and (ii) “The farmers will go to the fields."

The connective ‘If then' that connects the two propositions, is a truth functional connective which means that if the condition (given in the first simple proposition) obtains then the result (given in the second simple proposition) follows. Given this meaning the truth of this implicative proposition is solely determined by the fact that if the first proposition is true, the second also is true. Its falsity is solely determined by the fact that the second proposition is false even if the first is true. However, before making the claim that ‘If...then' is a truth-functional connective, and the, truth/falsity of the compound implicative proposition is a truth-function of the constituent simple proposition, we should first look into various type of implications.

8.8.1 Types of Implications

Implicative propositions are of various sorts and their truth conditions also vary from type to type. Let us see a few examples of implicative Propositions :

'If water boils up to 100 degree C then it evaporates'.

This compound proposition states a casual connection between two incidents. This is a connection which is known by experience, and its truth/falsity depends on external conditions.

Another example of implicative proposition :

If hard work brings success and hard work is done, then it will bring success :

This big compound proposition is one which is necessarily true independent of any matter or fact. Even the truth/falsity of constituent simple propositions does not affect the truth of this compound proposition. No matter whether the simple propositions **-'Hard work is done.** -is true or false, or whether the compound constituent proposition. **'Hard work brings success,** is true or false, the big compound proposition - **'If hard work brings and hard work is done, then it will bring success.**' -is true in every case. **This is a Toutology** and the implication stated through it is purely formal and logical. Its truth is given by its form.

Still another example of Implication, different from the other two :

'If ants are mightier than elephants then jackals are the kings of the jungles.

This sentence seems to be an implicative proposition but it is not. It is only a. figurative way of stating the impossibility or unlikely-hood of a situation.

In our natural languages we can make use of implication in vary many other ways also. In Logic where we need an un-equivocal meaning of a sentence we have to restrict the use of Implication to a specific type only. For this reason with the view of capturing the essential minimum sense Implication the proposition expressed through **'If....then'** type sentence, are given the special name 'Material Implication.'

In Material Implication the connective **'If.....then'** is interpreted as it is not true that the condition obtains and the result doesn't follow. Our first example of Implication.

'If it rains then the farmers go to the fields',

means, in this light, that

If is not true that it rains (or it rains -is true) and the farmers don't go to the fields (or 'The farmers go to the fields.' -is false).

This interpretation is accepted selectively by convention. This seems to be an arbitrariness which unreasonably cancels all other interpretation of the sentence starting with an 'If.....then'. But we will later see that it is not quite unreasonable as we can capture all other propositions expressed through implicative sentences by reformulating them as Material implication without any loss of meaning. But before that we now turn to claim that given this interpretation 'If.....then' is a truth - functional connective and, that Material Implication is a truth-function of its constituent simple propositions. In the light of this interpretation we can easily symbolically restate the above example (If it rains then the farmers will go to the fields) as: ~A (p~q).

Where 'p' stand for simple proposition 'It rains'.

and, ‘q’ stands for the simple proposition ‘The farmers will go to the fields'. 'stands for simple proposition ‘The farmers' will got to the fields.’

Now (since we know to draw the truth-table of Conjunction and Negation) we can draw the truth-table of this symbolic statements as follows :-

p	q	~q	p~q	~(p- v ~q)
T	T	F	F	T
T	F	T	T	F
F	T	F	F	T
F	F	T	F	T

TABLE - VI

The truth-functional connective 'if.....then' is symbolized by The logical sign ⊃ (horse shoe)

So the above example of Material Implication is symbolized as :

p ⊃ q

And its truth-table is as follows

P	Q	p ⊃ q
T	T	T
T	F	F
F	T	T
F	F	T

TABLE – VII

This truth-table shows that a Material implications is false only if the antecedent (condition) is true and the consequent (result) is false. In all other conditions it is true. The third row of the table seems to give a preposterous indication. It shows that a false proposition can imply a true proposition, which appears to be rationally unacceptable. This situation is well known as 'The Paradox of Material Implication'. But the paradox disappears if remind ourselves that this is an implication which is interpreted as the denial (negation) of the conjunction of the truth of antecedent and falsity of consequent. Since the falsity of either of the conjuncts makes the Conjunctive Proposition false and its negation true, therefore, it is quite logical that third row (that states that p is false and q is true) show the truth of the compound proposition resulting from the negation of the conjunction of p and ~q (F, -T is F, and ~ F is T). This situation is clearly given in the (truth-table-VII).

The truth-table of Material Implication provides a general term for all other senses of implication. This can be shown by giving different interpretations of implication and reformulating them as Material Implication without distorting their intended meanings. Let us consider our present example. In our daily life when we make the statement **if it rains them the farmers will got to the fields'** -we may intend to say at least two more, things apart from what is stated in it. We may mean that (i) if it doesn’t rain then the farmers will not got to the fields, and (ii) if it rain

then the farmers will got to the fields but they will not go there if it doesn't rain. Our original statement is **'If it rains then the farmers will go to the field.** And It is symbolized as 'p = q. Now, if by this we intend to say (i) then it can be symbolized as ~p = ~q' and its truth values can be solely determined by the following truth table.

p	- p	q	~q	~(p ~ q)
T	F	T	F	T
T	F	F	T	T
F	T	T	F	F
F	T	F	T	T

TABLE - VIII

The interpretation given in (ii) also can be reformulated as (P ⊃ Q). (~P ⊃ ~Q).

The conjunction of the results of Table - VI and that of E will determine the complete truth value of this interpretation. Hence we see that a selected interpretation of Implication as Material Implication doesn't restrict out scope of considering other interpretation, rather it helps in handling them more precisely.

8.9 Material Equivalence

Material Equivalence is that form of compound proposition in which two or more simple prepositions are connected to each other with the connective 'If and only if.....'

The sentence - India will gain respect in the world if and if it is strong - expresses Material Equivalence. In this proposition two simple propositions:

(i) India will gain respect

and, **(ii) India is strong.**

join together with the connective 'If and only if....'. This is a truth-functional connective that mean that both the simple propositions are true together or they are false together. The compound proposition **'India will gain respect if and only if it is strong.'** It is a truth-function of these two simple propositions since given this interpretation of the connective (if and only if...) we can solely determine all its truth-values. The compound proposition will be true when both the constituent propositions are true or it will be true when both are false. It will be false only when one of the constituents is true and the other is false. We can draw the truth table of this example of Material Equivalence as follows :

P	q	P ≡ Q
T	T	T
T	F	F
F	T	F
F	F	T

TABLE - IX

Here **'p' stands for "India will gain respect."**

'q' stands for India is strong.

and (three bars) is the logical sign for 'if and only if ...

It is not difficult to see that a Material Equivalence can be reduced to a conjunction of Material Implications in which both the simple proposition imply each other, e.g. the above stated compound proposition can be presented as follows :

$$(p \supset q).\ (q \supset p).$$

By drawing its truth-table we can verify that it is the same as Truth-table IX.

p	q	$(p \supset q)$		$(p \supset q)$
T	T	T	T	T
T	F	F	F	T
F	T	T	F	F
F	F	T	T	T

TABLE – X

8.10 Validity of the Argument and Argument Forms

We have studied the simple and compound types of propositions. Now we will study the method of logic with which we distinguish between correct and incorrect arguments.

We know that reasoning (or inferring) is a mental process. When the inference is precisely stated in a language, it is called an argument. Every argument contains a premise and a conclusion. Premises may be more than one in number, the conclusion is one. Both the premises and the conclusion, are propositions which can either be true or false. In logic an argument is regard as correct or valid when the conclusion is necessarily true if the premise/premises is/are true. Validity is regarded as the property of argument. One should never forget that arguments are not called true or false. Truth and falsity are the properties of propositions not of arguments. Arguments are valid or invalid. Premises and Conclusion of an argument are either true or false because they are propositions.

To determine the validity of arguments Aristotle studied their forms and found that valid arguments have a few specific forms. Every valid argument can be placed in one form or the other, and an argument which cannot be put in any of these forms, can not logically be valid. By the study of traditional logic we know that form is necessary to ensure the validity of an argument. In immediate inference proposition 'A' is converted into "I" this rule is based on the forms of the proposition. Similarly, we know that in IIIrd figure conclusion can never be universal. This rule is based on the form of the argument. It means to say that in Aristotelian logic the notion of validity is essentially tied to the understanding of the form. It never bothers about the actual meaning of the proposition.

The question of validity or argument is the central question in symbolic logic too. Being purely formal in nature this also does not take interest in the content of the argument but focuses its attention on the form only. Still the notion of validity in symbolic-logic is somewhat different from that of Aristotelian Logic.

The form of an argument in Aristotelian Logic is decided with respect to the question to full or partial inclusion of one term of the premise in the other. This is the core consideration to decide whether conclusion can be deducted from the premise or not. Obviously conclusion cannot contain any term which is not already present in the premise. But in symbolic logic we consider the question whether the conclusion follows necessarily from the premise. This consideration is wider in scope than that of Aristotelian logic. So all the arguments which are valid according to the traditional logic, are valid according to symbolic logic also. But if there is any argument in which a term which occurs in conclusion, does not occur in premise, yet the conclusion follows from the premise (i.e. if the premise is true the conclusion also is necessarily true, and can never be the case that conclusion is false while premise is true), then this argument would be valid according to Symbolic Logic while the traditional logic will render it invalid. It means to say that in Symbolic Logic the general principle of validity is this: if the premise are all true then the conclusion also must be true. This is the meaning of "logical entailment". If, on the contrary, the conclusion is not logically entailed by the premises then the argument will be regarded as invalid even if they are true in actual situation. The concept of "logical entailment" can be explained clearly with the following example of a valid argument. Let us suppose that two propositions are given in symbolic form as "p" and "q ⊃ p". Let us draw the truth table of these propositions :-

p	**q**	**q ⊃ p**
T	**T**	**T**
T	**F**	**T**
F	**T**	**F**
F	**F**	**T**

TABLE - XI

We see that in 1st and IInd rows where "p" is true "q ⊃ p" also is true. The truth table extibits all possible truth values of each proposition. Except for these, no other relations between the truth values of the proposition are possible. Therefore we can say that in every possible situation wherever "p" is true, 'q ⊃ p' also is true Not a single situation is possible where "q ⊃ p" is false while "p" is true. Thus "q ⊃ p" is logically entailed by (or follows from) "P".

Now if "p" is regarded as a premise, then "q ⊃ p" will be regarded as its conclusion which logically follows from the premise. This conception of validity is different from that of traditional logic. Traditional conception of validity which is based on form of argument (as determined by the idea of inclusion of terms into one another) cannot admit the validity of the argument.

p therefore q ⊃ p because “q” is a new proposition which does not occur in premise at all. Symbolic Logic widens the scope of the concept of validity and provides an effective method to prove it. Truth table not merely exhibits the truth functional character of compound propositions : it also serve as an effective method of proving validity of the arguments.

It is clear from the above discussion that all arguments are presented and tested in their symbolic form in Symbolic Logic. So, if we make a small list of a few valid argument forms then they can serve as "rules of inference" and help us in demonstrating the validity or invalidity of

innumerable example of specific arguments. At the higher level, the arguments are tested in this very way. Although symbolic logic represents proposition through symbols and their form alone is retained in this way, yet the form of a proposition is to be distinguished from the actual symbolic proposition itself. In an argument whose premises and conclusions are symbolically given a follow :-

(pq) ⊃ [r v (s.t)]
/∴ ~ (p.q)
~ [r **v** (s.t)]

The question of validity/invalidity can be decided by drawing the truth-table of the argument which will contain A, B, C, D and E simple propositions. This will be a huge truth table consisting of 32 rows. But if we study the argument carefully, we will be able to give it the following form :

p ⊃ q /∴ ~ p

~q

The validity (or invalidity) of this argument form can easily be decided by a small truth table consisting of only 4 rows. We can see that this is a valid argument form. We can apply this argument form as a formula to demonstrate that given argument also is valid because it has the same form. Valid arguments forms (whose validity is proved by truth table method) can serve as, "Rules of Inference" and help us in proving the validity of so many specific symbolic arguments with little labour.

Constituents of an arguments froms are written with small letters as a matter of convention to distinguish it from the argument written with same letters. So

p ⊃ q
------- /∴~p is an argument. Whereas
~q

p ⊃ q
------- / ∴ ~ p is an argument form
~ p

Check Your Progress

1. Identify the truth function of following propositions

a) p - q pvq - _____
T T T

b) p - q p.q - _____
T F F

c) p - q pɔq - _____
F F T

d) p - q p≡q - _____
F T F

Answers.

a) Disjunction

b) Conjunction

c) Implication

d) Equivalence

8.11 Summary

The lesson gave you a good introductory account of Symbolic Logic and also briefed you about the basic understanding of Truth functions and Truth Tables. From 8.5 to 8.9 you were given a comprehensive explanation of all the truth functions like – Conjunction, Disjunction, Wegation, Material Implication and Material Equivalence. Towards the end we discussed the idea of validity of the Argument and argument forms.

8.12 Glossary

Implication – A binary propositional connective normally represented by) and read as if and then

Conjunction – A binary truth functional connective normally symbolized as., like X and Y is represented X.Y. In truth table if X and Y is false.

8.13 Further Readings

2, 3

8.14 Model Questions

1. Define Symbolic Logic. State its nature of conjunction, Disjunction and Material Implication.
2. Prepare the Truth Tables for Conjunction, Negation, Equivalence.

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Lesson- 9

NATURE OF INDUCTION

Structure

9.0 Objectives

After reading this lesson you will be able to know to:

- State and explain Induction
- Assess the differences Induction and Deduction
- Critically analyse the scope and utility of Inductive Logic

9.1 Introduction

You have already studied that the major pre se of a *syllogism*, which is the most important form of deductive argument, must be a universal real proposition. A deductive argument can be of some practical purpose only if its conclusion is true. The conclusion validly deduced from the premises can be true only if the premises are true and a true conclusion cannot be validly deduced from false premises. But you must be aware that a deductive

argument is not concerned with the question of the truth of its premises, it is simply concerned with the question of deducing conclusion from the premises which are already there. It is not concerned with the question how the truth of its premises has been established. Thus, we face the following problem. How is the truth of a general real proposition which can serve as the major premise of a deductive argument established? This problem becomes the problem of a different type of reasoning called induction. In this lesson we shall try to understand the concept characteristics and significance of induction. The lesson will also give you a full understanding of the scope and utility of Induction along with making you understand how Inductive argument is different and distinct from deductive Argument.

9.2 Definition and Characteristics of Induction

Induction or inductive reasoning is considered to the reverse of deductive reasoning. Deductive reasoning consists in inferring particular or less general conclusions from already established general propositions or principles. Just reverse to it, inductive reasoning consists in establishing general proposition on the basis of the observation of particular facts. Where we argue from an established principle or law to its application in particular cases we argue deductively. But when we argue from one fact to another fact, or from a number of particular facts observed carefully to some general principle or law that explains them we are said to reason inductively. The nature of inductive reasoning as a process of thought from particular to general has been expressed in different ways by different locations J.S. Mill regards induction as "the operation of discovering and proving general propositions." Fowler defines induction as "the operation of discovering and proving general from the particular or of the more general from the less general". In this lesson we shall try to understand the concept characteristics and significance of introduction. In inductive inference, the premises, particular propositions obtained from direct observation of the facts and the conclusion is a general proposition.

The process of inferring general propositions from particular propositions, which is the essence of induction, is logically or formally invalid. But this process of inferring universal from the particular is justified on the assumption that the particular fact which we observe is not an isolated fact, but is an instance of a universal principle or a law of nature. This assumption, that the occurrence of events in nature is governed by definite laws, serves as the basis of inferring universal principle from particular facts. The assumption that there are certain laws and principles in nature is further analyzed in the form of two major assumption which are known as assumptions or presuppositions of induction. These assumptions are :

(1) The assumption of the uniformity of nature;

(2) The assumption of law of causation.

9.3 Special characteristics of induction

On the basis of this discussion, we may define induction as the establishment of a general real proposition on the basis of observation of particular instances, in reliance on the principle of the uniformity of nature and law of causation. Let us analyze this definition into the specific characteristics of induction.

9.3.1 Induction establishes general real proposition

The aim of Induction is to give us knowledge concerning actual state of affairs in the form of general real proposition. The proposition established by induction is not a particular proposition like some men are wise. It is, rather, a general proposition, like “All men are mortal. All crows are black. The 'general proposition establish by induction is not a verbal proposition

like" All bachelors are unmarried". It is rather a real proposition, a proposition which says something about the real state of affairs.

9.3.2 Induction is based on observation

The proposition established by induction is real proposition. The, establishment of the general real proposition involves generalization from the particular fact. Thus, the process of induction starts with the observation of facts. The particular proposition which are used as premises in an inductive inference are obtained by observing the facts. Experiment is also a form of observation. Observations and experiment through which the data or the material of induction are collected are called the Material Grounds of Induction.

9.3.3 Induction involves what is known as "Inductive leap" or "inductive hazard"

Induction involves generalization. To generalize means to pass from given a few instances to all the instances of particular kind: Thus in induction we pass from known to unknown. There is obviously a risk in the process of passing from known to unknown. From the observed to unobserved. But has been rightly maintained by such logicians as Mill and Bain that this leap from the known to unknown, known as "inductive leap" is the essence of induction. Any process in which thought does not move from known to unknown cannot be called induction.

9.3.4 Induction is based on two presuppositions - the law of causation and the principle of the uniformity of Nature

We have seen that induction is the process of passing from a few to all, from known to unknown from particular proposition to a general propositions. Now how can we justify this process? It is quite clear that according to the formal principles of deduction an inference of a general proposition from a few given particular propositions is invalid, Is there, then, any way to justify induction, that is the inference from particular propositions to general. Mill holds that this process of induction can be justified on the belief that Nature is uniform and that whatever occur in nature, occur according to the law of causation. Thus the principle of uniformity of nature and the law of causation are known as the formal grounds of induction. The law of causation holds that nothing happens without a definite cause. The principle of uniformity of nature holds that in nature similar events occur under similar circumstances. The essence of both these principles is that events in nature are governed by definite laws.

9.3.5 The conclusion of inductive inference is probable

The truth of the generaI real proposition established by induction is only probable. We cannot assert with certainty that the general propositions which we accept as true today will be true forever. Even the scientific laws which are established by scientific induction may be modified or even falsified with the discovery of new facts. In fact all empirical knowledge which includes all inductions, is only probable.

9.4 Scope of Inductive Logic

The scope of induction is the range of its subject-matter. As we have already seen that induction begins with particulars and establishes universals; in other words it aims at generalization. It is the function of induction to inquire into and determine the conditions under which a generalization is valid. What is its basis? How do we arrive at a generalization from some particular facts? All these questions come under the province of inductive logic.

9.4.1 The scope of inductive logic can be analysed as under :

(i) Inductive logic studies the nature and kinds of induction. *Induction per simple enumeration, argument from analogy and scientific induction are the three main forms of induction. There are certain other processes which have resemblance with induction Purity of Reasoning, colligation of facts and Perfect Induction are the three such processes.* Inductive logic studies the nature of all the processes

(ii) Inductive logic studies the nature and condition of *observation and experiment which are the materials grounds of induction*.

(iii) Inductive logic studies the formal Conditions of Induction. The Principle of Uniformity of Nature and the law of Causation are the formal grounds of induction. Inductive logic enquires into the nature of these principles.

(iv) Inductive logic studies *Experimental Methods.*

9.5 Experimental Methods of Mill's Methods of Induction

J.S. Mill has given five method of "discovering and proving casual relations". These methods are known as Experimental methods of Mills Methods of induction. Inductive logic studies the nature, uses and the limitations of these methods.

(v) Inductive logic studies the nature and the various steps of the scientific method; Scientific Method consists of the following steps :

1. Observation of facts which also includes the classification of the data collected by observation.
2. Formation of hypothesis to explain the observed data.
3. Generalisation of the hypothesis and deducing conclusions from the hypothesis.
4. Testing of these consequences by observation or experiment. Inductive logic studies all these steps of scientific method. It is specially interested in the study of the nature, and the conditions of a legitimate hypothesis, and its place of scientific inquiry Inductive logic studies such topics, as classification and nomenclature, scientific' explanation and fallacies of induction.

9.6 Uses of Induction

The following uses of induction can be pointed out :

1. Induction supplies the universal premises or premises of deduction. In deduction we argue from the general to the particular or from the more general to the less general. In deduction these general propositions are assumed to be true, and it for induction to prove their truth. Only a limited number of general truths are assumed as axioms or postulates without proof but the vast majority of general propositions are established by induction.
2. Induction supplies material truth. The aim of logic is attainment of both formal and material truth. Deduction proves only formal truth. Induction is necessary in order that the material truth may be established.
3. Induction reveals inner unity and harmony of the universe. At first sight, nature appears to be a chaos, but induction by discovering and proving laws governing the, phenomena of nature proves that nature is not really a chaos but a common.
4. Induction is the basis of all empirical sciences. All empirical sciences are based upon particular experience. It is thus clear that there cannot be an empirical science without induction. Scientific method is basically inductive in nature.

5. Induction is a necessary guide in our particular life. Particular life is guided by the generalizations based upon observation of a few instances. No planning with regard to the future is possible without first having some inductive generalizations. Without resorting to induction human life will come to standstill. Even the induction per simple enumeration is need in our daily life.

9.7 Distinction between Deductive and Inductive Inference

Students of logic generally carry this impression that Deduction is antithetical to deduction. Their impression steams from the confident statements of traditional logicians who maintain that Deduction is inferring a particular conclusion from universal premises. They further maintain that Induction involves in deriving a universal conclusion from particular instances. When Jevons wrote, **"Induction is in fact the inverse operation of Deduction and cannot be conceived to exist without the corresponding operation",** he clearly meant that deduction is that direct process in which on the basis of certain given data and a set of laws we arrive at a conclusion whereas Induction is the inverse process in which we try to go back to the data. Bacon also held Induction as an, "……ascending process while Deduction is the descending process." Buckle maintained that in Induction..... we proceed from facts to Ideas whereas deduction from Ideas to facts" To him Induction meant generalization and Deduction meant specialization of a general laws.

In his "The Philosophy of Inductive Sciences' William Whewell wrote, "..... in deduction we infer particular from general truths while in induction we infer general from particular." Just by way of reminding you we ask you to study 1he following two arguments :

(a) *Amar is a student of philosophy he is wise,*

Bharti is a student of philosophy, she is wise,

Charanjit Singh is a student of Philosophy, he is wise,

Denial is a student of philosophy, he is wise.

Ehsaan is a student of philosophy, he is wise.

All students of philosophy are wise.

(b) *All Indian folk-arts depict vibrant colours of life*

Swang is an Indian folk art

Swang depicts vibrant colours of life

Out of the two arguments (a) is an example of Induction and (b) is an example of Deduction. You have noticed that in argument (a) each of the constituent statements is representing a particular fact whereas its conclusion is making a general statement. But this point needs no reiteration that the conclusion is not logically supported by its premises. If at all we endeavor to observed all the members of the class 'philosopher' and then derive the conclusion we will be surprised to notice that the argument by then would not remain an inductive argument. Induction in this sense and form would become a Perfect Induction which is a kind of Induction in which the general conclusion is established after undertaking an exhaustive enumeration of all the instances which could be subsumed under a particular class, Perfect induction, will not at all be antithetical to Deduction because it is a form of a syllogistic arguments hence a deductive argument. But keep it in mind that Perfect Induction is not induction proper. Induction Proper is characterized by an Inductive leap which consists in

passing from some observed instances and extending it to other unobserved instances. In fact inductive leap constitutes the very essence of Induction.

When are compare the conclusion of both these arguments a and b we find that conclusion yielded by b is in fact contained in the premises of this argument which happens to be a syllogistic argument. However the conclusion of a establishes a new fact, a general real proposition. It establishes that which is not 'contained' within the given premises. But in B you will notice that the conclusion arrived at does not provide us new knowledge, It merely analyses the connotations of the term.

The most important point of distinction between these two arguments lies in the claim of the premises in providing conclusive grounds for the conclusion. Every deductive argument, if valid, claims to provide total conclusive ground for inferring the conclusion. Every Deductive argument unlike its counterpart in Induction is either valid or invalid. A Deductive argument is valid when it as impossible for the premises to be true unless the conclusion is true also. However - Inductive argument cannot afford to provide logical grounds for the conclusion because 'part' of the premises cannot conclude anything about the 'whole' of the conclusion. Part of the premise provide only 'some' ground for the conclusion. Hence the attribute at validity of invalidity, cannot be ascribed to an Inductive arguments whereas Deductive arguments are designated as valid or invalid keeping in view the rules observed by the arguments. Inductive argument can at best be assessed as a sound argument on a better An argument.

An Inductive argument is normally distinguished from a Deductive argument on the ground that, the conclusion established by an inductive argument is relatively more general than its premises. Whereas Deduction is taken to yield particular conclusions from general premises.

Take for example these two arguments.

(c) *(i)* *Bruno is a dog, it is faithful,*

(ii) *Shevta is a dog, it is faithful.*

(iii) *Sheru is a dog, it is faithful*

(v) *Boxy is a dog, it is faithful*

(vi) *Dabbu is a dog, it is faithful,*

Probably all dogs are faithful

(d) All dogs are faithful

Dingo is a dog

∴ Dingo is faithful.

Apparently, what has been said above seem to sound true but as a matter of fact not all Inductive arguments yield general conclusions and not all deductive arguments yield particular conclusions. An Inductive argument like the one given below may have all the general premises and a general conclusion as well.

All Crows are birds and warm blooded.

All Sparrows are birds and warm blooded.

All Parrots are birds and warm blooded.

All Pigeons are birds and warm blooded.

Similarly a deductive argument can be of this type-

If Bruno is a dog then Bruno is faithful

Bruno is a dog.

Bruno is faithful

So it is not at all necessary that an inductive argument should always proceed from less general to more general and a deductive argument from more general to less general.

9.8 Summary

Deductive argument and Inductive arguments differ from each other in a more significant manner i.e. deductive argument the conclusion is claimed to follow from its premises with absolute, necessity but in the case of an Inductive argument its conclusion is claimed to follow from its premises with probability and this probability is further dependent upon something else.

Deduction aims at arriving at a formal truth and it does not involve any physical efforts of observation or experiment. Induction on the other hand aims at material truth which is impossible until some amount of observation of experimentation is undertaken. The general statements formulated by Induction form and essential ingredient of a deductive argument. We may not be certain of the truth of the general conclusion of inductive arguments but once they are adopted by deductive arguments they are presumed to be true.

Out of the two forms of arguments Induction is more concerned with the truth or falsity of its premises than Deductive. Deductive arguments lay special emphasis on the logical rules. Which they must abide by and induction endeavours to establish the material truth of its premises. An inductive argument cannot attain the logical certainty which a deductive conclusion can claim and a deductive argument cannot establish the material truth of its premises.

Check your Progress

1. Mention three ways in which a deductive argument is different from an Inductive Argument.

For answer refer 9.7

2. (a) What is Inductive Leap?

   (b) Why an Inductive inference is probable?

   (c) What is the assumption of Uniformity of Nature?

For answers refer 9.2, 9.3.3 and 9.3.5

9.9 Glossary

Induction – Induction is one of the major type of argument where the we move from specific particular instances to a general conclusion is not certain and not fully supported by its premises.

9.11 Model Questions

1. What is Induction? What its scope and utility.
2. State and explain the special characteristics of Induction.

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Lesson-10

KINDS OF INDUCTION

Structure

10.0 Objectives

After Reading this lesson you will be able to:

- State and define Induction and its major kinds
- Identify and discuss different kinds of Induction
- Assess the value of different kinds of Induction

10.1 Introduction

In the previous lesson you were introduced to Induction, its nature and its unique characteristics. This lesson takes you a step further and introduces you to different kinds of Induction, Induction per simple enumeration and Analogy. It in fact it will began by clarifying that Induction is quite ambiguous and it is used to denote different senses. Here you will learn that Induction has two kinds of types. The first one is called **Induction improperly so called,** like its name denotes it is not proper induction but since there is some similarity, normally it is mistaker as Induction. Later you will get a detailed account of all the major forms of Proper Induction. Use this you will study-

Scientific Induction, Induction by Simple enumeration and Argument from Analogy.

10.2 Induction Proper and Improper

The word *'Induction'* is highly ambiguous and has been used in various senses. According to Mill, a distinction must be made between *(1) Inductions improperly so called and (2) induction proper.*

10.3 Inductions Improperly so called

Inductions improperly so called are those processes of reasoning which have only superficial resemblance with induction but which lack, the essential characteristics of induction. The processes are also called "processes simulating induction" Mill holds that these processes are of three types i.e. *(A) Perfect Induction (B) Induction by parity of reasoning, and (C) Colligation of facts.*

10.4 Prefect Induction

The process of establishing a universal proposition on the basis of the observation of each and every instance that comes within its sweep is called perfect Induction. As it is based on the complete enumeration of the instances, it is also called "Induction by complete enumeration". We first examine separately each and every member of a class and then combining all our observations we make a general statement regarding all the members of the class. Suppose M is a class and ABCD and E only are its members. We first examine, A and find that it has the property of being K. Then, we examine B and in this case also we find that it is K. thus, we examine separately all the five members of the class M and in the case of each member, we find that it is K. On the basis of this comlete enumeration, we conclude that all M are K. We can express the general form of Perfect Induction to the following way :

A B C D and B are K

A B C D and E are all M.

All M are K.

Example I

I enquire of Sohan. Navneet, Irfan, Sam and Madhu about their age and find that each one of them is under twenty five Sohan, Navneet, Irfan, Sam and Madhu are all students of my class. I, therefore, conclude that all the students of my class are under twenty five.

Example 2

I examine each and every book in a book-shelf and ten make a general statement that all the books in that shelf are text-books of logic.

Example 3

About every month a year, we first separately know that it has less than thirty two days. Then, we make a general statement, that all the months in a year have less than thirty two days.

10.4.1 Characteristics of Perfect Induction

This discussion reveals the following important characteristics of *perfect Induction.*

1. It is based on observation of individual instances.
2. It is based on complete enumeration.
3. It does not involve inductive leap. In the process known as perfect induction, we do not pass from known to unknown.

4. There is no real generalization in it. The general proposition stated in the conclusion is only a summary statement of all the particular statements, which form the premises.
5. Perfect Induction is not a real or proper form of Induction as it does not involve "inductive leap" which is the essential characteristic of induction. J.S. Mill rightly maintains that the so-called perfect induction is not interference at all, far less an induction.

10.4.2 Value of Perfect Induction

Jevons rightly emphasizes the importance of perfect induction by saying. "If perfect induction were no more than a process of abbreviation, it is yet of great importance and to be continuously used in science and common life. Without it we should never make a comprehensive statement, but should be obliged to enumerate every particular... perfect induction is absolutely necessary to enable us to deal with a great number of particular facts in a very brief space". Even *Mill* recognizes that the operation of writing a number of propositions in an abridged character which perfect induction involves may be very useful, and it plays an important part in the preparation of the materials for the investigation or truth.

10.5 Induction by Parity of Reasoning

Induction by parity of reasoning is a process of inference in which we establish a general proposition on the ground that the same reasoning which establishes a particular case will establish every other similar case coming under the general proposition. This process of inference is called parity of reasoning because parity (or similarity) is the ground of passing from a particular case to a general proposition. This is illustrated in geometrical proofs. For instance, we draw ABC, the diagram of a triangle on a piece of paper and prove that its three angles are equal to two right angles. Heaving proved this with the help of this diagram, we establish the general proposition. 'All triangles have three angles as equal to two right angles", because the same reasoning which applies to this diagram will apply to every other diagram of a triangle which we may draw.

10.6 Parity of Reasoning and Induction Proper

According to *Mill, Induction by parity of reasoning* is not induction, induction is generalization from observed facts. But in parity of reasoning, there is no observation of facts. For instance the general proposition, "All triangles have three angles as equal to two right angles" is not based on the observation that several triangles, DEF, EYE, etc., have been found to posses this attribute. Here, we take particular diagram, this diagram stands for all triangles at once. Hence when something is proved of the diagram, it is at once proved of all the things for which the diagram stands. We do not observe that particular concrete characteristics of particular diagram e.g. the length of its sides and the size of it angles etc. The diagram is used for the purpose of explanation or illustration. In the words of *Carvet, Read, 'Diagrams* are not used as facts of observation, but merely to fix our attention in following & general argument. Therefore, parity of reasoning cannot be called induction proper.

It should further be noted that geometrical reasoning is in no sense inductive, but purely deductive in character. In Geometry, we start with certain axioms, postulates and definitions and we proceed deductively to draw conclusions from them. For example, we define a triangle as "A plan figure bound by these straight lines'. From this definition, the conclusion, "All triangles have their three angles as equal to two right angles" follows deductively. The attribute "equality of three angle to two right angles" is a property of "triangle" because it follows from the connotation

of the latter. Hence, the proof is a deduction from the definition of triangle. Thus, the so-called induction by parity of reasoning is not induction at all but is purely a deductive process.

10.7 Colligation of Facts

The term "colligation of facts" means binding together or mental union of a number of observe facts by means of a suitable notion. Mill defines a colligation thus: *Colligations is that mental operation which enables us to bring a number of actually observed phenomena under a description; which enables us to sum up a number of details in a single proposition".* For instance, a navigate sailing in the midst of the ocean discovers land; he cannot at first determine whether it is a continent or an island but he sails along it, and after a few days he finds that he has arrived exactly at the same point from where he commenced his journey in a way he has completely sailed around it; he declares that the piece of land he has arrived at is an island. This is an example of colligation of fact because the navigator brings together under the notion of an island, the set of facts observed by him.

Colligation of Facts should not be regarded as induction because of the following two reasons *Firstly,* in colligation there is no inference at all. Certain facts are observed and brought together under a notion which we already possess. The navigator already possesses the notion of an island and he brings together the fact observed under the notion. He does not make an inference from fact observed to facts unobserved. Mill, therefore, considers colligation of facts to be nothing more than a mere description of general terms. In induction, on contrary, we observe certain facts and pass to a general proposition comprising facts observed as well as facts unobserved. Secondly, in colligation we merely observe facts, while in induction we further seek to explain them. In induction we do not merely say that men are mortal but explain why they are so by proving a causal connection.

In colligation, there is no attempt at explanation by proving any connection amongst facts observed. Mill maintains that colligation may be "a process subsidiary to induction" or “a necessary preliminary to induction” but induction is something more than colligation. As he says, "Induction is colligation but colligation is not necessarily induction”.

10.8 Induction Proper

Inductions proper may be subdivided into

(A) Scientific induction;

(B) Unscientific induction or induction per simple enumeration or imperfect (enumeration);

and

(C) Argument from analogy.

10.9 Scientific Induction

'Scientific induction is the establishment of a general real proposition, based on observation of particular instances, in reliance on the principle of the uniformity of nature and the law of causation.

10.10 Unscientific Induction or Induction by Simple Enumeration

Induction by simple enumeration is the establishment of a general real proposition on the ground of more uniform or uncontradicted experience without any attempt at explaining a casual connection.

It never happens that we get a complete enumeration of instances. Generally, we have to be contended with a section form all the instances of a kind and find that each has a certain characteristic. If we meet no instance without that characteristic, we generalize the conjunction into a connection like, "All crows are black." "All men are Mortal." The general form of induction per simple enumeration will be as follows :

all the known instances of G_1 G_2 G_3 C_4 are H

All the instances of G (known as well as unknown) are. H.

Concrete Example

(1) All the known crows are black. Therefore, all the crows are black.

Example 2

All the known parrots are green. Therefore, all parents are green. Following are the important characteristics of inductive per simple enumeration.

1. It involves generalization. It establishes general real proposition.
2. It involves inductive leap. There is a jump from known to unknown in it.
3. The conclusion is only probable: The particular causes observed cannot form the sufficient evidence to justify the establishment of a general proposition. *An induction per simple enumeration* is based only on the observation of instances and on the establishment of casual connection. It is *only probable.* There always, remains the possibility of its being falsified by a new contrary instances.

10.10.1 Value of Induction Per Simple Enumeration

It is generally said that conclusions of induction per simple enumeration are merely probable while those of scientific induction are certain. For Bacon, *induction per simple enumeration do not have any importance.* As he puts it *"induction which proceeds by merely citing" instances, a childish affairs, and being without any principle of inference, it may be overthrown by contradictory instance'.* Many logician oppose Baon's, view-point. The uncontradicted experience of all known men, in all known parts of the globe, during all the known periods of history, in absence of contrary instances gives a very high degree of probability, however, is a matter degree. According to Fowler the value of induction depends on two considerations.

(A) Firstly, "the number of positive instances which have occurred to us." If the number positive instances which have occurred in our experience be large, the value of the argument comparatively high; while if their number be small, its value is rather low.

(B) Secondly, "the likelihood, if there be any negative instances, of our having met with them." If there be no negative or, contrary instances induction per simple enumeration attains a high degree of probability.

In scientific induction on the other hand, the carefully tested observation of a single case may justify a general conclusion, if a casual connection is established.

We may conclude by saying that induction per simple enumeration may, in a large number of cases, be the starting point of scientific inductions. As Grumly puts it: *"The chief value of the enumerative, methods lies in its power to suggest casual relation: The condition that the phenomena (subject and predicate) are always or very frequently connected seems sufficient ground for entertaining the hypothesis that they are casually related. Inductive*

enumeration then, is not altogether worthless from the scientific point of view, it is at least a valuable aid….. induction proper'.

10.11 Argument From Analogy

Analogy is the name of another mode of Argument of an inductive character, which is a form of scientific induction. Mill holds that analogical reasoning may be reduced to the following formula. “Two things resources each other in one or more respects; a certain proposition is true of the one, therefore it is true of the other “Carveth Read defines analogy as a “kind of probable, proof based on imperfect similarity between the date of comparison and the subject of our inference." Thus, analogy is a kind of inference from particular to particular, based on imperfect similarity and is only probable in character. The general form of the argument can be put as follows.

A which is M is x

Therefore B which is like A is being M is also X

Let us take a concrete example:

Mars resembles the Earth in certain respects, viz. in being a planet, in possessing similar atmosphere, laid, evidence of seas, polar regions, temperature (neither too hot nor too cold for life) revolving round the Sun and borrowing light from the Sun, etc.

The Earth possesses the further property of being inhabited.

Mars also possesses the property of being inhabited.

The ground of inference in analogy is resemblance, we argue that two things alike in some respects are also alike in some other respect.

10.12 Analogy and Scientific Induction

Analogy is recognised as induction proper because there is in it an inductive leap from the known to the unknown. Analogy, however, is a weak form of inductive argument because it is based on imperfect similarity. The difference between analogy and scientific induction can be described as follows :

1. In scientific induction, we proceed from particular to general, while in analogy we proceed from particular to particular. In analogy, from the observation of one particular instance, we pass on to another particular instance which has not been observed. Some logicians maintain that when we argue from one particular to another particular which resembles the former in certain attributes we do so because we have implicitly formed in our minds a universal representing the common attributes, and we unconsciously bring forth the instances under that universal. The difference between analogy and induction is that while in induction we consciously express the universal in the form of a general proposition, we do not do so in analogy; though in both cases we rely on the universal element in the particular as the ground of inference. Therefore, we can say that analogy as long, as it remains analogy only, "sticks in the particular instances without working out a law of connection between them.
2. Unlike scientific induction, analogy is not based on the law of causation. In analogy, we merely find a resemblance between some circumstances in the

phenomena to be explained and some phenomenon with which we are already familiar and we use the latter as a basis for the conclusion about the former.

3. The conclusions of analogy are merely probable while those of scientific induction are certain. As analogical argument however, strong, cannot attain the certainty of scientific induction as it is established, on casual connection.

10.13 Value and Importance of Analogy

Analogy may be described as a stepping stone to scientific induction. There is a vague belief that though no casual connection is at present known to exist, such a connection will at some future time be discovered, and the analogical argument will perfect; itself into a scientific induction. Till the desired goal is reached analogy is regarded, as a stage on the road to scientific induction or in the words of Mill, *'a guide-post pointing out the direction in which more rigorous investigations should be prosecuted."*

Analogy is a source of hypothesis, which when proved results in scientific induction. Many of the most important scientific laws are suggested by analogy. The analogy of a falling apple suggested to Newton led to the formulation of the laws of gravitation. The analogy of competition in the industrial world suggested to Darwin the principal of natural selection as the basis of evolution in the animal world.

Let us discuss the strength of an argument from analogy. An argument from analogy may be so weak, that it may sound to be non-sensical or it could also be quite strong and may be a useful guide in daily life as well as in our scientific inquiry. How, can we determine the strength of argument from analogy?

The strength of an argument from analogy could depend upon the following three factors :

1. Number of the known simple points.
2. Number of the known dissimilar points
3. The relevance of the known points of similarity and dissimilarity.

Therefore, in order to assess the strength of an argument from analogy, we should count the points of similarity and dissimilarity and also weights or assess their relevance.

10.14 Summary

This lesson began by clarifying that Induction has two types of Arguments. One of them Inductions improperly called so, are in fact nor Induction as such because they do not fulfill the characteristic of Induction. Later you we discussed all the proper forms of Inductions and considered the value significance of these Inductive arguments.

10.15 Glossary

Analogy – An inductive form of argument which is based on some elements of similarity of two or more objects and concluding that both the objects are also having a similarity on some other aspects.

Scientific Induction – An inductive argument which establishes a general real proposition based on observation of particular instances in reliance on the principle of uniformity of nature and law of Causation.

10.16 Model Questions

1. What are major kinds of Inductive argument coming under induction proper.
2. What is Inductively by Simple enumeration. Discuss its value.
3. What is Analogy. Illustrate your answer with suitable example.

Check your Progress

Q.1 What is an Analogy? Give a real life example of Analogy.

For Answer refer 10.11

Q.2 Why perfect Induction is not considered Induction improper?

For Answer refer 10.2 and 10.3

Q.3 Create your own concrete example of Induction by Simple Enumeration.

Refer 10.10 for assistance

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Lesson-11

CAUSATION

Structure

11.0 Objectives

After reading this lesson you will be able to:

- Define what is a cause
- Reproduce the key characteristics of Causation
- Summarize the Philosophical background of Causation

11.1 Introduction

Every event has a cause and nothing happens without any cause. The common sense belief in the principle of 'causation has been the most fundamental presupposition of all scientific quest. Whenever we think of an event we are led to think that it begins at some point of time, before which it was not there. The idea of its beginning naturally leads us further to think as to how did it begin. Thus emerges the idea of the cause of an event. Let us try to understand it with the help of an example. If we start heating a bowl full of water then after sometime it starts boiling and the water turns into vapours; before boiling the vapours were not present. How did vapours came into being? It came into being due to boiling of the water. Boiling of water is the cause of vapourization. Taking the above example as a model let us reflect upon the notion of causation:

11.2 What is a Cause?

It should be clear that cause is not a thing or a substance. Ordinarily while talking of cause of an event we say that it came out of that thing: e.g. it is quite a common way of saying that the earthen pots are made up of clay. Therefore clay is the cause of earthen pots. This way of talking reminds us of the ancient Aristotelian typology of cause (which we will see briefly in the end of this lesson) according to which clay is the material cause of earthen pots.

11.2.1 Cause is an event

When we inquire more deeply into the nature of cause we will find that it is an event (not a thing) that cause another event. In our above example vaporization is caused by the boiling of water. So far as material substance is concerned vapour is water, Naturally they are not different. But if we try to understand the phenomenon of change of water into vapour, we find that boiling of water has brought about this change. Therefore boiling of water is the cause of vaporization. In the example of 'earthen pots' the making of 'a pot is an event and it is caused by the skillful moulding of clay by the force applied on it by the potter's hand. An event is happening and always originates in some other happening that occurred before it. Growing a plant from a seed is caused by the prior event of pushing of sowing the seed in the ground touring 'of the wheels of a train is caused by the event of pushing of piston in the cylinder by the compressed steam: movement of a rocket is caused by the event of reaction in the form of high thrust generated by the hot gases oozing out of its back.

Whatever example of causation we take, we see that an even is always caused by some other event. An event is a fact of change. A change is possible only by the occurrence of change in prevailing condition. That is itself an event. Hence cause is always an event.

11.2.2 Cause is an antecedent of an event

The question of cause arises only with beginning of an event. So it is quite obvious that we think that cause always comes before an event. In the example given above we see that vaporization takes place only when water boils. Before boiling water does not vaporize. Boiling is the condition that has to be fulfilled in order to evaporate water. Same could be said to all other examples. So it seems quite natural to think that cause always comes before use event.

A generalization of cause as a prior event however, needs to be dealt with cautiously. One can cite examples where cause comes much after the occurrence of the event. A student studies hard to get success in the examination. In this case the cause of the event of studying hard is the goal of getting success, which has to be realized only in future. So the cause in this case, one can argue, comes much after the happening of an event.

It is, however, no difficult to defend the general position of precedence of cause against such arguments. It could be pointed out that the success in the examination is not the cause of studying hard in this case. It is not the event of the actual success but the aspiration for getting success that causes the event of studying hard. The actual result is not present (it can't be said to be present in potential form either). Hence it cannot effect the present course of action of the student. It is the student's aspiration for success that motivates him, or causes his decision to study hard.

One can also argue in this case that it is not a legitimate example of cause. One can say that there is a difference between cause and reason and the above example 'getting success' in examination is the reason for the student's action (of studying hard). A future, event can be imagined in present so it can serve as a reason for a present event.

The notion of cause as a prior event can be clear about the nature of the precedence. In this context it would be necessary to reflect upon the distinction of *logically prior and temporality*

prior. A concept is said to be logically prior to another concept if the understanding of one in necessarily presupposed in the understanding of the other. On the other hand a phenomenon if the one comes before (in time}; the other. If we say 3 comes before 4 then we are not saying anything about their temporal order. Here we are just stating a hat 3 is logically (or mathematically) prior to 4. The order is logically necessary because it can't be changed. If we try to do so it would result into a logical absurdity or self-contradiction. If we try to, place 4 before 3 then a mathematically true statement '4 is greater than 3' will be false which is logically absorbed. The notion of temporal priority on the other hand, indicates only temporal order and does not result into violation of any logical truths if the order is changed. A peon comes in the office before the boss. It is true because the actual sequence of arrival of the peon and the boss is stated rightly. But if we change the, sequence, then it would not become unintelligible (as in the case of changing the order of 3 before 4 turns out).

It should be clear now that cause is only temporally prior to an event. It is by no means logically prior. Cause of an event comes before it in time. It does not logically come first. Had it been logically prior to the event changing their sequence would have resulted into violation of some logical truth. But in any of the examples cited above we do not find that putting the cause after the effect does so.

11.2.3 Cause is Empirically Necessary

Although cause is only temporally prior to an event to its cause is by no mean a temporary one. The cause is deemed to stand in a sort of necessary relation to the event it produces. This necessity is not logical. It is of empirical nature. An event can't be thought of occurring in the absence of its cause. We can't think of vaporization of water without it's being boiled. Though there is no logical absurdity in thinking that the vaporization of water takes place without it's being boiled but if it happens indeed then we will have to amend out understanding of the essential properties of water. If a liquid vaporizes without boiling then either we will say that it is not water or we will have to admit that out knowledge of chemical and physical properties of water needs revision. If the causal relation between two events is doubled then it puts a question mark on our understanding of the essential nature of that event itself. In this sense the casual relation is a necessary relation. Logically it is possible to think of this falsity but in actual experience it is never found to be false. *This is an invariant relation.*

11.2.4 Cause as conditions

On the basis of above discussion we can define cause as the invariant antecedent of an event. However, cause can also be looked at as the set of conditions which necessitates the event. For the occurrence of any event certain set of conditions has to be fulfilled. In our above example boiling is the condition which has to be fulfilled in order to vaporize water. Thus boiling of water is the cause of vaporization.

Defining cause in terms of conditions however, needs a closer examination of the various types of conditions. Often we take one condition as the sole cause of an event, e.g. when we strike a match-stick on the side of the match box fire comes out, and we say that striking of match-stick is the cause of fire. While it is true that striking of match stick is the tainting factor here it is not the whole cause of burning of match stick. If the match box or the stick were wet, fire could not have come out, or if the match stick was struck on the match box is vacuum even then fire could not have come out. Apart from just striking of match stick on the match box some other conditions also have to be fulfilled. So our, habitual way of saying that striking the match stick on the side of the match box is 'the cause of fire does not give a true

description of the cause. A cause is the whole set of conditions which is responsible for the occurrence of an event.

Very often, a negative condition is taken as the cause of an event. When the absence of a condition arrests the occurrence of an event we think that the condition is the cause of the event. In the absence of oxygen nothing can burn, so we ordinarily say that oxygen is the cause of burning. But just by a second reflection we can see that although the presence of oxygen is necessary for burning it is not sufficient for that. Some other conditions such as rising of temperature of the mater to a certain degree must also obtain for burning. While defining cause of an event not only necessary conditions should be taken into considerations but all those conditions should also be taken into account which makes the combination of conditions sufficient for the production of an event. Thus while it is true that light is a necessary condition for seeing any object, it is not sufficient for that. A healthy eye, the proper function of optic nerve and optic job of brain, absence of obstruction between the eye and the object also are equally necessary for making the vision possible. The cause of the event of seeing must be stated in terms of a complete description of all these conditions.

It is difficult at times to enumerate all the conditions sufficient for the production of an event and usually what we call as cause of an event is just an incomplete description of dominant necessary course of scientific research as well we can't state a complete set of conditions responsible for the occurrence of an event. This incompleteness, however, does not come in way of the research and does not affect the validity of experiments provided the set of condition is only incomplete but not wrongly conceived. If the set of conditions deemed to be the cause of an event is incomplete because of the limit of our knowledge than by further research we can add more conditions in the set and can make the combination more accurate. But if due to ignorance or some other reason some such conditions are included in the set of conditions which is not necessary indeed then, of course, our consideration of that set of conditions as cause needs correction.

11.3 The Philosophical Background of Causation

Before we conclude our discussion of causation we should look briefly in its philosophical history. The first clear reflection on the notion of cause is found in Aristotle's thought. In Aristotle's opinion cause is something that produces something else or brings about a change. He divides cause into four types viz. *'Formal cause", 'Maternal cause', 'Efficient cause' and 'Final Cause'.* Formal cause is the form or idea (in the mind of the maker of a thing after which the product as shaped or the change is given direction. Material cause is the matter of substance out of which a thing is produced or that which is changed into some other form. Efficient cause is the power which is applied for producing a thing or brining about a change. Final cause is the goal or the aim due to which the change is brought about.

The notion of cause conceived in these four types has some metaphysical value but so far as the scientific thinking as concerned except for the efficient cause others are not relevant. The division of form and matter had relevance only in Aesthetic course apart from metaphysics. Final cause or the goal is obviously out of the scope of scientific discourse because no science can believe (or presuppose) a goal behind the laws of nature. Though human sciences give importance to human goals and does consider as a factor for change, but is given place at a very late stage of development of human being and not in the beginning. It can't occupy a place of pre-supposition as it is in- Aristotle's philosophy. Thus only the idea of efficient cause remains left as worth considering.

In modern, philosophy the notion of cause as power drew the allocation of many philosophers. The British empiricist John Lock has laboriously tried to prove that cause is a power which goes from one object to another and produce an effect. It is like moving a billiard ball which when hit another ball sets the other also in motion: the power due to which the first ball was moving is transferred to another. George Berkeley also thought it obvious that cause is nothing but power. But it was David Hume, an English philosopher who for the first time explicitly doubted over this notion of cause. Causal relation as we saw it in the above discussion, is not a logical relation between two events. The relation is regarded only factual one. But Hume inquired as to how do we know that this relation is necessary. He criticized the notion of cause as a power and argued that we never see the transfer of power from one object to another. What we see at the most is the, sequence of events one event occurs and after that second occurs, and we have seen the recurrence of this sequence in past but we never see (observe or experience) the phenomenon of transfer of power. Moreover though we see the recurrence of the sequence we don't find anything out there in their happenings so that we can get a ground for attributing necessity to their relation. Hume argues in the effect that the idea of casual relation as a necessary relation is only an outcome of human habit it is not factual. Since we have seen two events happening together in a sequence always in past our mind habitually starts expecting them to happen together in future too. Thus the idea of necessary relation crops up. But it is just our mind's projection. It is not a fact of matter. Hume, thus puts a question mark on one of the oldest native beliefs of mankind.

The great German philosopher Immanuel Kant who raised from the dogmatic slumber regarding our belief about universal causation, very solemnly took the task of examining the grounds of our cognition. He finally came to the conclusion that the idea of universal causation is not - fact of matter but a category of understanding. He admitted that Hume was right in holding that the necessity of casual relation is not a fact of experience; it is not out there in nature. It is only the form in which human reason understands the going together of two events. Kant's argument is subtle and complex but in a plain manner we can grasp in the following way it is not the fact of going together of two events that gives us the idea of universal causation. It is not an empical generalization, rather it is the other way round. It is the category of causation which human reason projects on two events and grasp it as a sequence of events that go together. If there were no such category present in human understanding conceiving two events as a happening in a sequence would have been impossible. (It can be though after the analogy of colour blindness to any particular colour, say red. If a person is colour blind for red then he can't see anything red. Similarly if human understanding has not the category of causality then he/she can't even see two events happening in a sequence). Thus seeing of two events happening in a sequence or going together bound in a necessary relation is due to the category of understanding. Although Kantian notion of causation is not final and can be criticized (indeed it, has been criticized by the thinkers of Realist and Positivist-schools). However, it gave a new direction to our understanding of the issue. From the epistemological point of view the principle of causation is one of essential presuppositions of all empirical knowledge (Knowledge about the world); which is although criticized but can't be substituted by any better idea. So far as the methodology of science is concerned the principle of causation serves as a postulate.

11.4 Plurality of Causes

Cause is defined as a totality of necessary and sufficient conditions for the happening of an event. When all the conditions join together the occurrence of an event becomes inevitable and it doesn't occur if something is missing from them. However, in common parlance it is very often said that an event can take place due to various causes. If a house is burnt to ashes in

fire, we normally guess that it could have happened due to electric short circuit, or due to a burning gas stove which would have been mistakenly left open or some one would have deliberately put it on fire by sprinkling petrol etc. In brief, we think of various incidents as the possible causes of this event. It means that people normally believe in the plurality of causes of any event.

J.S. Mill, who had propounded the Method of Experimental Enquiry was a supporter of the view that an event can take place due to more than one cause. Since he believed that many causes can produce an event, he gave superiority to the Method of Difference over the method of Agreement.

The belief in the plurality of Causes can be presented in a logical form also. In Hypothetical Syllogism accepting the consequence is regarded as a fallacy.

It is given that P implies Q, and if it is also given that P is true, then in conclusion we can accept logically that Q is true. But if it is given that P implies Q, and if somehow we come to know that Q is true than we cannot logically draw the conclusion that P is also true. This is fallacy and known as the Fallacy of Accepting. The Consequence. The principle that one specific event is cause by only specific cause, which is contrary to the belief in the Plurality of Causes, can be shown to be a Fallacy of Accepting the Consequence because here we intend to prove that if some event has taken place than prior to it only a specific conditions as its cause must have cropped up (that means we proceed from the truth of Q to the truth of P). Thus some people believe that Plurality of Causes is logically defendable also.

11.4.1 Critical Assessment

Plurality of Causes, however, is not regarded as a right principle. Although we generally talk about many causes of the same event, a careful examination makes it, clear that it is a false belief. Every specific event happens only in the presence of specific cause only. If it were not true that only a specific cause produces a specific event, then it would have never been possible to reach at the cause of an event after investigating the happening. A careful examination of every condition of the happening of an event we can, and do, really ascertain which specific event caused it. Although in our above example it seems that there may be vary many causes for the fire that burnt the house, a careful investigation at the end in fact enables us to reach at one definite cause of the fire. We can at the end decide that it was not gas leakage or sabotage that put the house on fire, but it was only the electric short circuit due to which is happened. This proves the falsity of the belief in the plurality of causes. In fact when we talk about the plurality of causes, we mistakenly accept the necessary conditions as the cause itself. In the above example gas leakage is only a necessary condition of the fire in the house because it explains only that fire would not have broken out if combustible substance-like gas, were not there in the house. But it can't explain where from the spark of fire came and what made it spread everywhere so rapidly. Short circuit in electric line, gives satisfactory answer to all the questions. It satisfies the necessary conditions and sufficient conditions also.

So far as the problem of above stated logical fallacy is concerned, it becomes clear that there is no actual fallacy involved here, because specification of the conditions of happening and elimination of unnecessary elements in the effect, makes the relation between cause and effect somewhat like a relation of equivalence instead of the relation of implication. We can say that the event of electric short circuit implies that this house caught fire in this specific form, and this specific form of the event of catching fire of the house implies that an electric short circuit took place.

Plurality of cause, therefore, is a false belief.

For a layman one effect could have more then one cause but the fact of the matter is each effect is unique and it will be caused by a unique cause only. Apparently the effect seems to look similar to another effect but the one effect caused by one cause in fact different from the second effect caused by a second cause. Plurality of cause, therefore, is a false belief.

Check your Progress

1. Mention any three characteristics of causation by reflecting on a concrete example.
2. Can there be more than Causes of the one effect? Explain briefly.

11.5 Summary

Causation is one of the most fundamental nations of all scientific question logicians can help them achieve it better by clarifying the very nation of Causation. This lesson in fact, would have given you an idea what all logicians have thought about Causation, what are its key characteristics. Like you must have known that cause is an event, Cause is an antecedent of its effect, Cause is an empirical necessity. This lesson also gave you a thorough understanding of the doctrine of Plurality of cause which claims that one effect could have a number of causes. Like an be caused by – a splinter, a short circuit, natural lightening, a spark. But on a critical assessment you would have seen that this belief is not tenable.

11.6 Glossary

Cause – an essential antecedent condition of a phenomenon, on which it is invariably and unconditionally, depends.

Plurality of Causes – the doctrine states that it is possible that the same effect may be caused by more than one cause, as pollution could be caused by either vehicular emission, industrial emissions or mining, chemical farming.

11.7 Model Questions

1. Define cause, state some major characteristics of a cause.
2. What do you understand by Plurality of Causes? Critically evaluate this doctrine.

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UNIVERSITY SCHOOL OF OPEN LEARNING
PANJAB UNIVERSITY, CHANDIGARH -160014

Student Response Sheet No. I
Enrolment No. …….. **Sub. Philosophy**
Class : B.A. Sem. II **Lesson No. 1-11**
Paper : Logic

Detach this response-sheet, write on it your name and address in capital letters in English script, tag with it your answer sheet and then either despatch it by post or deposit personally at the counter of USOL. It should be addressed to the Chairperson, USOL, Panjab University, Chandigarh -160014 and should reach this office within one month of the despatch of the lesson-block to you. Each of the response-sheets be tagged separately, though mailed in the same envelope. Use foolscap paper for your answers.

(DO NOT TEAR AWAY QUESTIONS PLEASE)

Time : 3 Hrs. **Marks : 90**

Note : Attempt five questions in all, selecting at least one and not more than two questions from each section. Question No. 1 is compulsory. All questions carry equal marks.

1. Write short notes on any nine of the following. Restrict your answers to 25-30 words only.

1.	Deduction	7.	Validity
2.	Laws of thought	8.	Term
3.	Proposition	9.	Causation
4.	Syllogism	10.	Obversion
5.	Analogy	11.	Positive term
6.	Reasoning	12.	Contradiction

Section-I

2. Define Logic and discuss its nature and scope.

Or

Logic is a science of valid reasoning, Discuss.

3. Explain the classification of Propositions by Aristotle.

4. What do you understand by a Term? How it is different from a word?

Or

Explain the differences between Connotation and Denotation of a term. How are the two related?

Section - II

5. What is Syllogism? Give the rules of valid inference in Syllogistic form of argument.

6. Find out the validity or invalidity of the following Syllogistic arguments:

   (i) Some Good actors are not Strong men, but all Professional wrestlers are strong men. Therefore all Professional wrestlers are not Good actors.

   (ii) Some snakes are not dangerous animals, but all snakes are reptiles. Therefore some dangerous animals are not reptiles.

   (iii) Some Spaniels are not Good hunters, but all Spaniels are Gentle dogs, therefore no Gentle dogs are Good hunters.

Or

What is the difference between Figures and Moods? Explain any four valid moods of the IInd figure.

Section-III

7. What is Inference? Distinguish between Immediate and Mediate form of inference.

Or

What is Categorical Syllogism? State the rules of Quality and Quantity.

8. What are symbols and how are they useful in logic? Explain.

Or

What do you understand by a truth table? Prepare the truth tables of the following propositions:

(A) Conjunction (B) Disjunction (C) Equiralence

Section - IV

9. Discuss the nature, Problems and importance of Induction.

10. What do you understand by the term 'Cause'? Discuss its chief chacteristics.

Or

Define Introduction. Explain Perfect Induction and Parity of Reasoning. Why are they called improper Induction ?

(TO BE FILLED IN BY THE RESPONSE SHEET EVALUATOR)

Name of the Evaluator with address:_____

_____

Percent of Marks _____Remarks: _____

Signature