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LOGIC : CLASSICAL AND SYMBOLIC

By: Poonam Singh

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QUESTION PAPER

(June - 2019)

(Solved)

LOGIC : CLASSICAL AND SYMBOLIC

Time: 3 Hours]

[Maximum Marks: 100

Note : (i) Answer all the five questions.
(ii) All questions carry equal marks.

Q. 1. Describe Venn diagram. Use Venn diagrams to show distribution of terms.

Ans. Ref.: See Chapter-6, Page No. 47, Q. No. 7 and Page No. 38, 'Diagrammatic Presentation of Distribution'.

OR

Explain different kinds of dilemma in detail.

Ans. Ref.: See Chapter-7, Page No. 49, 'Kinds of Dilemma'.

Q. 2. Define Logic. Is it a positive or normative science? Elaborate.

Ans. Ref.: See Chapter-1, Page No. 1, 'Various Definitions of Logic' and Page No. 2, 'Logic: Positive Science or Normative Science'.

OR

Write a detailed essay on Induction.

Ans. Ref.: See Chapter-8, Page No. 58, Q. No. 1 and 2.

Q. 3. Answer the following questions:

(a) Construct formal proof of validity for the following :

(i) $(V \Rightarrow \neg W) \wedge (X \Rightarrow Y)$

Ans. $\Rightarrow (\neg(\neg W) \vee \neg V) \wedge (\neg Y \vee \neg X)$
(Using Material Implication)
 $\Rightarrow (W \vee \neg V) \wedge (\neg Y \vee \neg X)$
(Using Double Negation)

(ii) $(\neg \Rightarrow WZ) \wedge (Y \Rightarrow \neg A)$

Ans. $\Rightarrow (\neg W \Rightarrow \neg Z) \wedge (Y \Rightarrow \neg A)$
(Using Material Implication)
 $\Rightarrow (\neg(\neg W) \wedge \neg Z) \wedge (\neg Y \vee \neg A)$
(Using Double Negation)
 $\Rightarrow (W \vee \neg Z) \wedge (\neg Y) \vee \neg A$

(iii) $(Z \Rightarrow \neg B) \wedge (\neg A \Rightarrow C)$

Ans. $\Rightarrow (\neg Z \vee \neg B) \wedge (\neg(\neg A \Rightarrow C))$
(Using Material Implication)
 $\Rightarrow (\neg Z \vee \neg B) \wedge (A \vee C)$
(Using Double Negation)

(iv) $V \wedge X / \therefore \neg B \wedge C$

Ans. $\Rightarrow (\neg V \wedge X \wedge \neg(\neg L \wedge X))$
(Using / $\therefore V \wedge B$)
 \Rightarrow Law of association say that
 $\Rightarrow \neg V \wedge (X \wedge \neg(\neg L \wedge X))$
 $\Rightarrow (V \wedge X) \wedge \neg(\neg L \wedge X)$.

(b) Explain the nature and scope of logic.

Ans. Ref.: See Chapter-1, Page No. 6, Q. No.1.

(c) Explain Figure and Mood with example.

Ans. Ref.: See Chapter-11, Page No. 77, 'Figures and Moods'.

(d) Using truth-table technique, prove the invalidity of the following arguments :

(i) $E \Rightarrow (F \vee G)$

Ans.

E	F	G	(FVG)	$E \Rightarrow (FVG)$
1	1	1	1	1
1	1	0	1	1
1	0	1	1	1
1	0	0	0	1
0	1	1	1	1
0	1	0	1	1
0	0	1	1	1
0	0	0	0	1

(ii) $G \Rightarrow (H \wedge I)$

G	H	I	$(H \wedge I)$	$G \Rightarrow (H \wedge I)$
1	1	1	1	1
1	1	0	0	1
1	0	1	0	1
1	0	0	0	1
0	1	1	1	1
0	1	0	0	1
0	0	1	0	1
0	0	0	0	1

(iii) $\neg H / \therefore E \Rightarrow I$

Ans.

E	I	$E \Rightarrow I$
1	1	1
1	0	1
0	1	1
0	0	1

H	$\neg H$
1	0
0	1

Q. 4. Answer the following questions:

(a) **Construct truth-tables for disjunction and conjunction.**

Ans. Ref.: See Chapter-12, Page No. 88, 'Disjunction and its Equivalent Forms' and Page No. 90, 'Conjunction and Bicondition'.

(b) **Explain conversion and obversion.**

Ans. Ref.: See Chapter-6, Page No. 42, 'Conversion' and Page No. 43, 'Obversion'.

(c) **How is falsification non-inductive?**

Ans. Ref.: See Chapter-8, Page No. 57, 'Function of Falsification'.

(d) **What is categorical syllogism?**

Ans. Ref.: See Chapter-11, Page No. 76, 'The Structure of Categorical Syllogism'.

(e) **What are the limitations of Aristotelian logic?**

Ans. Ref.: See Chapter-9, Page No. 62, 'Limitations of Aristotelian Logic'.

(f) **Write a comment on truth and validity.**

Ans. Ref.: See Chapter-5, Page No. 33, Q. No. 1.

Q. 5. Write short notes on the following:

(a) **Kinds of Generalization**

Ans. Ref.: See Chapter-5, Page No. 35, Q. No. 6.

(b) **False Cause**

Ans. Ref.: See Chapter-7, Page No. 53, 'False Cause'.

(c) **Division by Dichotomy**

Ans. Ref.: See Chapter-3, Page No. 20, 'Division of Dichotomy'.

(d) **Categorematic Words**

Ans. Categorematic words include all types of nouns. A negative example can explain it in better way. For instance, 'It is very cold today', in this sentence the word 'very' cannot be used independently. It will make no sense to write 'It is very'. And this word cannot be used as 'subject' is to assume that out of many oranges some are sweet. Here, some is not used in the sense of subject, though it seems to be. Without any proper knowledge of the context it cannot be understood. 'Dhoni was the captain of Indian team'. In this sentence Dhoni is used independently as subject.

(e) **Existential Instantiation**

Ans. Ref.: See Chapter-16, Page No. 117, 'Existential Instantiation'.

(f) **Contrary and Subcontrary**

Ans. Ref.: See Chapter-6, Page No. 37, 'Contrary and Subcontrary'.

(g) **Weakened and Strengthened Moods**

Ans. Moods are boxed in two ways. Moods within thick boxes are called strengthened moods, and moods within thin boxes are called weakened moods. It is important to know the difference between these two. When two universal premises can yield only particular conclusion, then such moods are called strengthened moods. On the other hand, if we deduce particular conclusion from two universal premises, when it is logically possible to deduce a universal conclusion, then such moods are called weakened moods. When we recall that from universal premises alone particular conclusion cannot be drawn, both strengthened and weakened moods become invalid. Thus, the number of valid moods reduces to fifteen.

(h) **Proposition**

Ans. Ref.: See Chapter-4, Page No. 24, 'Propositions and Sentences' and 'Types of Propositions'.



Sample Preview of The Chapter

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LOGIC : CLASSICAL AND SYMBOLIC LOGIC

Nature of Logic

Nature and Scope of Logic



INTRODUCTION

General conception about logic is this that it originated in Greece but the matter of fact is this that all great civilizations of the world like Indians, Arabs, and Chinese have also made big contributions in this realm. But the present course of study is limited to the European logic only.

Reasoning is expressed through arguments, either good or bad. So every argument raises this question, whether the conclusion reached validly follows from the premises or not? The objective criteria on the basis of which this answer is given, is the subject matter of the study of logic.

CHAPTER AT A GLANCE

VARIOUS DEFINITIONS OF LOGIC

Derived from the Greek word logos, the term logic literally means word, thought, speech, reason, energy and fire. But in the present context it is used to the discipline which deals with rules and methods of thought, reasoning and argument. Statements based on emotional appeals are of no use in logic. Only statements related to the fact which can be proved true or false, are of importance in logic. So, the aim of logical study is to discover and decide the criteria to prove the validity of the arguments. The assessment of various definitions of logic can be done only taking into consideration this aim of logic.

According to Susan Stebbing logic is a study of reflective thinking (*A Modern Introduction to Logic*) while H. W. B. Joseph was of view that, thought in its unqualified sense is the main theme of logic. (*Introduction to Logic*). But since the subject matter of both the definitions are subjective one, it is of no use

for the assessment of logic. On the basis of the three laws of thought one can assert the view that logic is the study of thoughts. But it will be a misunderstanding because laws of thought merely tell about the nature of statements. So, thought cannot be accepted as the subject-matter of logic.

Another rejected definition of logic mentions it as the study of the methods or principles which we can use to distinguish good reasoning from bad reasoning. But all types of thinking process is not reasoning though all kinds of reasoning is thinking. Thinking processes like imaging, day dreaming cannot be called reasoning though all these are also governed by the same laws of thought. But these thought processes don't exist within the domain of logic. The subject-matter of logic is that type of reasoning in which on the basis of premises certain conclusions are drawn. The correctness of this whole procedure of reasoning is the subject-matter of logic.

It is not meant by this definition that a student of logic reasons well or surely follows these rules. But there is every possibility of his reasoning correctly because of his learning and practicing the rules of logic. Furthermore, study of fallacies makes the student of logic aware of the pitfalls of reasoning. Any student of logic can detect the errors of reasoning and remove it immediately. But the lacunae in this definition is this that it is also subjective in its nature because of its dependence on the person who reasons. According to some logicians logic is the science of inference. This definition isn't also accurate one though it is better than others. It is also subjective in its nature because of its dependence on the person who reasons. Though, inference being a part of logic it has its own importance in the field of logic.

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To differentiate good argument from the bad one is the main function of logic. This special characteristic of logic is its defining feature. There are two parts of any argument: One is premises and another is conclusion. If the conclusion follows from the premises then only the argument is valid otherwise it is invalid. And to make any argument good it is necessary to follow certain rules, violation of which will lead to drawing wrong conclusion.

To draw conclusion from premises it is necessary that the premises imply them. By drawing conclusion one has to extract whatever is implicit in the premises. Since premises imply the conclusion that's why the relation between the premises and the conclusion is that of the implication. Any human being has to extract the latent conclusion in the premises through proper use of logical reasoning. This relation of implication is objective reality because of its being independent of the person who is reasoning. It is not within the power of the thinking mind to create this relation of implication if it is missing there. So, it can only be extracted when it is already there and this procedure of extraction is called inference. Logic is merely concerned about the existence or non existence of this implication.

The validity or invalidity of inference depends upon this relation of implication. If there isn't any relation of implication between the premises and conclusion then it is invalid. But this relation of implication isn't in itself valid or invalid. Further, statements simply imply, it is human being who infer. So, any mistake regarding inference can be committed by human being only. Any error cannot be pointed out in the relations of the statements. Also, existence of valid inference depends on the relation of inference though implication can exist without inference. So, by replacing inference by implication we can make logic objective and it is necessary to make knowledge objective.

Still philosopher like Russell like to use the term inference and logic has only rules of inference not rules of implication. But the irony is this that the by the term inference is meant implication, here.

TWO TYPES OF LOGIC: FORMAL AND MATERIAL

The subject-matter of logic is based on two factors: form and matter. On the basis of these two factors, logic has been classified into two types: (i) Formal and (ii) Material Logic. Being based on form, formal logic is also known as deductive logic whereas being based on matter, material logic is also known as inductive logic. Formal logic deals with the form of the argument while

material logic deals with the matter of the argument. Matter, being inessential, material facts are also irrelevant for deductive logic. The only matter of concern for deductive logic is the formal truth of inference. The logical relation between premises and conclusion, which is known as the relation of implication is considered as formal truth. That's why, to know the formal truth, content of argument is not necessary. For any deductive or formal argument, being valid, merely it is necessary to follow the rules. To summarize this, it is appropriate to say that any argument with false propositions may be valid whereas any argument with true propositions may be invalid. Therefore, to assess the validity or invalidity of any argument merely it is necessary to know that whether all the rules of game has been followed or not without any concern about material.

Contrary to it, material logic which is known as inductive logic is based totally on the content of the argument. Nothing can be decided about the truth and falsity of the conclusion without any knowledge about the content. But the situation is something vague about the rules of inductive logic. Some philosophers are of view that there is no rule to be followed in inductive logic. Resultantly, it is difficult to decide that whether any argument is valid or invalid.

Thus, we may say that the place of inductive inference in the realm of logic is indistinct.

LOGIC: SCIENCE OR ART?

Now it is important to decide whether logic is a science or art. And the answer of the question will depend on the definition of science and art itself. Contemporary definition of science differs from the ancient one which defined science as a systematic study of anything. But now-a-days it is being defined as a branch of knowledge which aims at explanation of phenomena. On the basis of this criteria, logic cannot be said to be a science. Further, since art is concerned with doing something, logic can be defined as an art, only in derivative sense. So, only after deciding the aim of logic, it can be said that whether it is an art or not. Of course, logic gives us knowledge about valid argument form but it doesn't make us apply that in our practical life. Therefore, we can say that logic isn't an art but science that is also in general sense not in technical one.

LOGIC: POSITIVE SCIENCE OR NORMATIVE SCIENCE?

Now after being it decided that logic is a science the next question arises that whether it is a positive

science or a normative one? As a positive science is related to the matter of fact, normative science tells us what ought to be the case. In the view of some logicians be a formal science logic is normative science. As Latta and Macbeath write, The form of thought is the way in which we think of things, the matter of thought is the various particular objects we think of. A form is something which may remain uniform and unaltered, while the matter thrown into that form may change or vary.

Any normative science gives us the criteria on which we can decide our value judgements. The judgements of normative sciences tell us what ought to be the case. Logic is a normative science in this sense that it decides the general conditions on which the validity of inference depends. We apply these conditions while arguing because there are certain objective relations between the statements and they have to be kept in a certain order to maintain the objective relations between them. The structure and relations of statements which are the norms of logic are merely formal.

Quite different is the view point of other logicians who consider logic as descriptive science because it doesn't give certain norms for reasoning but merely describes them. Whereas, the reality lies between the two as logic is neither a positive science nor a normative one. Being based on purely formal proposition, logic cannot be claimed to be positive science. At the same time it cannot be asserted about logic that it is normative because it doesn't lay down principles for value judgement but simply to distinguish valid argument from invalid ones. Logicians only give the exposition of the principles used for valid arguments.

Thus, we reach to the conclusion that distinction of positive negative is not applicable for logic.

LOGIC AND OTHER DISCIPLINES

Logic and Epistemology: The central theme of epistemology is the theories of knowledge. To decide the structure, conditions, instruments and its limitation of human knowledge is the function of epistemology. Epistemology makes use of logic to form its theories though it is not formal science like logic because of its subject-matter being subjective. A part of epistemology which is called epistemic logic determines the limits of logical norms to be applied on epistemological problems. Though logic and epistemology are related with each other yet it is that type of genus and species. Being based on discursive reasoning, logic remains

restricted to formal methodologies. Whereas, epistemology is related to the matters of fact which is across the realm of logic. In the same manner logic also goes beyond the realm of epistemology.

Logic and Metaphysics: Since being is the subject-matter of Metaphysics, it is considered as the mother of all knowledge. And to examine the pre-suppositions of various sciences is its primal task. Metaphysics helps in an enquiry about the basic assumption of logic that thought gives knowledge. It also does the crucial work of differentiating of real from unreal and determines the standard of reality. In fact, logic is the connecting link between metaphysics and science because it gives the abstraction of the bases of the principles of science.

Logic and Psychology: Since thought is the central theme of both psychology and logic, both are related to each other. But there is a crucial difference between the two because of logic of logic being limited to the thinking process of normal adult human beings whereas psychology examines the thought process of animals, infants, abnormal peoples and criminals as well. Further, whereas the matter of concern for logic is the abstract forms of thinking while psychology deals with the real procedures of thinking. The abstractions derived from our thought process by logic aren't the events in our minds. That's why, these are not the subject matter of psychology.

Logic and Language: Nature of language used in the arguments affects its quality. Various functions like giving information, evoking emotions, stimulating actions, making references are performed through natural language whereas language of logic merely conveys information. That's why emotively neutral language is needed to express the logical facts which are simply true or false. It explains merely the matters of fact. So, out of three categories of language *i.e.*, informative, expressive and directive logic is concerned with the informative language. Many philosophers are of view that since structure of language and logic are identical therefore, it is necessary to remove the ambiguity of language to maintain the structure of logic.

Logic and Physical Sciences: Society now-a-days is science oriented. Scientific facts are based on observations of natural events and their generalizations. On the basis of these generalizations science gives theories about laws of nature. That's why the method of science is both observational and reflective one. The function of logic is to draw valid conclusion from the

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available facts. So, logic helps science in drawing conclusion from available facts.

Logic and Mathematics: Gottlob Frege found arithmetics as advancement of logic and based mathematics on pure logic. Further addition was done by discoveries of non-Euclidean schools of geometry and certain paradoxes by Russell, Cantor and others in later period. Resultantly, there was Frege-Russell thesis which declared mathematics as an extension of logic.

Taking a different standpoint G. Peano tried to draw a parallel between mathematics and logic. But all these efforts were nothing sort of making logic similar to mathematics instead it was an effort to make mathematics similar to logic. Kronecker raised objection against the ideas of Cantor by alleging that his theories were much more mysticism than mathematics. Same was the objection raised by Poincare against Zermelo. He held the view that number system couldn't be reduced to logic. He was against reducing mathematical induction to logic though he was in favour of building up mathematical concepts inductively by proceeding from particular to general. He was of view that induction is not logic. In fact, Poincare was in favour of following deductive method regarding mathematics because mathematical induction is not possible. He opined that following certain rules of logic doesn't reduce mathematics to logic.

But a different definition of mathematics *i.e.*, the science of formal proof or logical demonstration brings it closer to logic. Since both logic and mathematics deal with relations between propositions disregarding the content of them, both are formal sciences. That's why both may use symbols as an alternative to words. The relations discussed by both logic and mathematics are applicable on actual as well as possible objects.

Further, since both logic and mathematics begin with axioms and deduce conclusion from them both are deductive in nature and their methods are *a priori*.

DEDUCTIVE AND INDUCTIVE LOGIC

Deductive and Inductive are two types of arguments. On this basis, logic also has been divided into two types. Arguments of deductive logic comprise two parts: Premises and conclusion. Conclusion of the deductive argument is implied in the premises. It has to be deduced and expressed. So, by accepting premises one accepts the conclusion also. Deductive arguments are found in mathematics and geometry. The validity or invalidity or consistency or inconsistency of a deductive argument has to be ascertained not the truth

or falsity. Arguments are always either valid or invalid whereas propositions are either true or false.

Second type of argument *i.e.*, inductive argument is the subject-matter of inductive logic. A particular group of philosophers are of view that physics, sociology and psychology consist such type of inductive arguments. In fact, inductive arguments are based on the theory of causation and works through generalizations and predictions. Generalization is the very foundation of inductive logic. In inductive logic, on the basis of few observations one draws the conclusion by generalizing the available facts. The truth of the conclusion is assumed on the basis of the truth of premises which don't include it. That's why the conclusion of the inductive logic is always probable one. Probability is the hallmark of inductive logic.

CHECK YOUR PROGRESS

Q. 1. Bring out the various definitions of logic.

Ans. The word 'logic' has been derived from the Greek word 'logos', which means word, thought, speech, reason, energy and fire. But, since these literal meanings don't signify the term accurately, these were replaced by some more accurate meanings which can give the sense of what we actually learn when we do logic. In this way logic was established as a discipline, dealing with thought, reasoning and argument at different points of time.

Emotive statements are useless for logical arguments though they have importance in our practical life. Only rational statements which are based on objective facts and verifiable are useful in logic. In logic it is necessary to analyze the criteria on the basis of which any argument can be appraised. Therefore, the definition of logic must be like that which could delineate all these aspects of logic. So, taking into consideration this need, all the definitions of logic must be analyzed.

Susan Stebbing suggested the definition of logic as, 'The study of reflective thinking' in her book "*A Modern Introduction to Logic*". Of course, it was a step further to the definition of H.W.B. Joseph who defined logic as 'the study of thought in its unqualified sense' in his book "*Introduction to Logic*". But unfortunately both the definitions don't suffice the essentials of logical arguments as both has accepted logical content as psychological one, which is resultantly subjective.