UNIT: 2 SYMBOLIC LOGIC AND TRADITIONAL LOGIC

UNIT STRUCTURE

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2.1 LEARNING OBJECTIVES

After going through this unit you will be able to-

- define symbolic logic and classical logic
- discuss a modern comprehensive symbolism
- explain the characteristics of symbolic logic
- identify variables used in symbolic logic
- identify ideograms and phonograms
- describe deductive method
- explain the importance of the use of symbols in logic
- explain the development of symbolic logic.

2.2 INTRODUCTION

This unit will familiarize you with different concepts of symbolic logic, and also will introduce you with different specialized technical symbols

(variables), which help to fulfill the aim of logic. (The aim of Logic is to express the form of the argument and to determine their validity and invalidity).The different concepts are:

- Concept of classical logic in philosophy
- Nature and characteristics of symbolic logic
- Different stages of development in symbolic logic
- The relation between symbolic logic and classical logic
- Functions and the importance of the use of symbols in symbolic logic

2.3 NATURE OF SYMBOLIC LOGIC

Before we discuss it in detail we must know something of its origin. That is why, it will be necessary to begin with classical logic to discuss the nature of symbolic logic.

- **Concept of Classical Logic in Philosophy:** Classical logic is the name given to that part and the treatment of formal logic which have come down substantially unchanged from medieval times. Classical logic is also known as 'Traditional Logic' or 'Aristotelian Logic'. The Greek philosopher Aristotle and his followers propounded it and had made such an elaborate treatment of this branch of study of about 2000 years ago. As Aristotle propounded it so this logic is also known as 'Aristotelian Logic' by his name. Aristotle formulated this logic so brilliantly and thoroughly that it covered the thinking of the Western world till the middle of the 19th century. And most of the Aristotle's successors thought it to be a finished science on which no improvement could be made. Aristotelian logic is also known as 'Classical Logic' or 'Traditional Logic'.

  Symbolic logic is a development of classical deductive logic and has emerged as a result of the use of the large amount of symbols in accordance with modern mathematical methods and principles. Modern logic represents a later phase in the development of logic,

which is comparatively recent origin. Symbolic logic is the name commonly given to the modern treatment of deductive logic. In the middle of the 19th century, some eminent mathematicians started to use the symbols of algebra for explaining the principles of classical or traditional logic. The extensive use symbols brought about significant change in the 'Traditional Logic' and the developed form of this is known as 'Modern Logic'. Modern logic stands for a group of studies and is called by different names as 'Symbolic Logic', 'Mathematical Logic', 'Algebra of Logic', 'Logistics' etc. Modern logic is basically known as Symbolic logic, is evident from its name involves the extensive use of symbols. Symbolic logic is a modern development of logic, used synonymously with Modern formal logic. Aristotle had made an elaborate treatment of this branch of study.

Symbolic logic is that form of logic which is developed in recent past, in which specialized technical symbols are used extensively to express the arguments and to determine their value. Symbolic logic is the developed, refined and mature branch of study, and based on the concepts and techniques used in Aristotelian logic. Like Mathematics the method of Symbolic logic is mathematical, deductive and formal in nature. Symbolic logic as a formal logic is concerned with only formal truth, not with the material truth of propositions.



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Formal truth: A proposition is formally true if the proposition is true because of the very form or structure of the proposition.

Materially true: A proposition is materially true if the proposition is true as a matter of fact. It is the fact that determines whether the proposition is true or false.

2.4 CLASSICAL LOGIC AND SYMBOLIC LOGIC

Though there is a very close relation between classical logic and symbolic logic but there are some important points of differences involved in the process and the development of symbolic logic. They are:

- DISTINCTION BETWEEN SYMBOLIC LOGIC AND CLASSICAL LOGIC
  - **Classical Logic has a long history where as Symbolic Logic has a very short history:** Classical logic has a very long history behind it which has been formulated by Aristotle about 2000 years ago, where as symbolic logic is very recent origin and is developed in the later part of the nineteenth century before 150 years ago. Thus, symbolic logic is comparatively recent origin and has a very short history. (This modern developmental process began in the 19th century). The success of reasoning in mathematics has inspired some thinkers to extend such apriori, deductive thinking in logic also. As a result of this symbolic logic emerged in its present form. So, it can be said that the difference between classical logic and symbolic logic lies in the difference of different stages of development.
  - **In Classical Logic symbols were used to a limited extent where as in Symbolic Logic symbols are used very extensively:** Aristotle used variables in classical logic also, but in a very restricted way only to represent the terms used in arguments by the letters of the English Alphabet in order to bring out the logical structure of arguments. But the use of variables in symbolic logic is much wider than that of classical logic.
  - **Symbolic Logic has a very comprehensive use of symbols:** Symbolic logic is an improvement upon traditional logic in the sense that it has adopted symbolism in a comprehensive way and through the use of its technical language it has become a powerful tool for analysis and deduction. The exclusive use of deductive method has made it more accurate than the classical logic. But the use of symbols in classical logic is very limited.



Aristotle* (384-322 B.C):-** A Greek Philosopher had born in Stagira, Macedonia in Greece. He is best known as the author of ***Ethics.

- **Regarding the classification of propositions, the modern classification is an improvement upon the classical classification of propositions:** In classical logic a proposition is classified into four types-A, E, I and O only. But in modern logic a proposition is classified into three types - Simple, Compound and General.

A simple proposition is again of four types:

(a) Subjectless,

(b) Subject predicate,

(c) Relational and

(d) Class membership proposition.

A compound proposition is again of four types-

(a) Conjunctive proposition,

(b) Disjunctive proposition,

(c) Implicative proposition

(d) Alternative proposition.

A general proposition is of three types-

(a) Existential proposition,

(b) One predicate universal proposition,

(c) General propositions asserting relation between two classes.

- **Classical treatment of relation is extremely unsatisfactory because classical logicians only recognized one kind of relation between the subject and the predicate (the relation of proposition):** According to classical logicians the copula is only capable to express all types of relations. But modern logicians think that the copula of classical logic is not only capable to express all types of relations. Modern Logic recognizes only a limited function of the copula.

From the above considerations, it may safely be maintained that the difference between classical logic and symbolic logic is one of degree only and not of kind. There can not be any fundamental difference between symbolic logic and classical logic. Though the word symbolic has been

applied to modern logic but it was not the case that symbols were used for the first time by only modern logicians. Aristotle for the first time made use of the symbols namely 'variables' but the use of variables in classical logic was limited to syllogistic inferences only, which helped to express the form of the arguments only. Modern logic grows out of traditional logic itself, and does not contradict traditional logic. The implicit principles and techniques in the classical logic are made more explicit in symbolic logic in the light of modern mathematical development. Thus, it can be said that modern symbolic logic is a developed form of classical logic. So, Basson and O'Connor remarks- 'Classical Logic is related to Symbolic Logic as embryo to adult organism' ***(Introduction to Symbolic Logic, p.3)*** **Thus, the difference between classical logic and modern logic is only that of different stages of development.**



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Simple Proposition: A simple proposition is that which contains only a singe statement.

Compound Proposition: A compound proposition is that which contains two or more statements.General Proposition: A general proposition is that which asserts that one class is wholly or partially included or excluded from another class.



ACTIVITY: 2.1

- Do you find any similarity between classical logic and symbolic Logic? Discuss

Ans ……..

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CHECK YOUR PROGRESS

Q 1: State whether the following statements are true or false:

a) Classical logic is also known as 'Traditional logic' or 'Aristotelian Logic'. (True/False)

b) Modern logic is a development of the classical logic.(True/False)

c) Symbolic logic is concerned with formal truth.(True/False)

d) Symbolic logic is a recent origin.

e) The difference between classical logic and modern logic is one of degree only and not of kind. (True/False)

f) According Basson and O, Connor, classical logic is related to symbolic logic and is narrower in scope. (True/False)

Q 2: Who is the founder figure of traditional logic?

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Q 3: Mention only two distinctions between classical logic and symbolic logic.

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2.5 DEVELOPMENT OF SYMBOLIC LOGIC

Modern logic has adopted a comprehensive symbolism. It has become a powerful tool for analysis and deduction through the use of its technical language. In order to study the historical background of symbolic logic; we have to focus our attention to the time of Aristotle who first build up logic as a separate branch of study.

The triumph of abstract reasoning in the field of pure mathematics throughout the ages, has tempted people to extend the range of such 'a priori' and 'deductive thinking' to other fields also. Accordingly, various attempts were made, in the seventeenth century, to construct a kind of generalized art or science of reckoning, so as to extend the field of formal

logic. The most important worker in this field in the second half of 19th century was Leibnitz, who has brought about revolutionary developments in the traditional logic by using mathematical techniques and methods in logic. Leibnitz developed logic into a full-fledged mathematical language. In his book, "Dissertio de Arte Combinatoria" he has given the hint to develop a universal scientific language through some fundamental ideographic notation as well as by developing a calculus of reasoning, all problems arising out of the universal language can be solved.

Modern logic is said to be a joint venture between mathematics and philosophy. Because after Leibniz the foundation father of symbolic logic includes George Boole, Augustus-De-Morgan, W.S. Jevons, Giuseppe Peano, Gottlob Frege, C.S.Peirce, Russell etc. In the middle of the nineteenth century the two English Mathematicians George Boole and Augustus De Morgan presented a systematic mathematical way to logic. Augustus de Morgan attempted to extend the sphere of formal logic, specially of the doctrine of the syllogism, by taking into account other kinds of relations between the terms of a proposition than those commonly expressed by the copula 'is' or 'are'. He pointed out that the copula in any case has several different meanings, for it expresses sometimes the identity of objects having different names, or one concept has the same content as another. The actual character of a relationship must be determined in each case by knowledge of the relevant facts. Symbols can only be used to express such knowledge, not as a substitute for it. Thus, the foundation of the logic of relations was laid by Augustus De Morgan. W.S.Jevons elaborately simplified and discussed the Algebra of Classes with him.

The first moderately successful attempt to construct an algebraic or quasi-algebraic logic (Symbolic Logic) was made by George Boole. He published two important contributions to the subject, namely, "The Mathematical Analysis of Logic, Being an Essay Towards a Calculus of Deductive Reasoning (1847), and "An Investigation of the Laws of Thought on which are founded the Mathematical Theories of Logic and Probability (1854). A very remarkable contribution of Boole had proved him as the



***George Boole* (1815-1864):-** A British mathematician born in Lincoln, England.



Augustus de Morgan (1806-1871):- He was an English mathematician and logician born in India.

founder father of symbolic logic. He proved that the syllogistic reasoning is a special case of a kind of logical algebra. He also discussed the logical analysis, application of the deductive method and Calculus. He employed the literal symbols x, y, z, etc., to represent 'things as subjects of our conceptions'; the signs of operation +, -, x, for the combination or resolution of conceptions of things 'so as to form new conceptions involving the same elements'; and the sign º for identity (or the equivalent of "is").

During the later decades of the nineteenth century, E.Schroeder (1841-1902), C.S.Pierce (1839-1914) and several others made further attempts and valuable contributions towards symbolic logic by developing algebra of logic. John Venn carried on the works taken up by Boole and Jevons by his significant contribution of diagram known as Venn's diagram to represent class relations. In his 'Symbolic Logic', John Venn tried to criticize and systematize all the results achieved up to his time. From this the name "Symbolic Logic" was used for the first time. He used the term 'class' in the sense of a 'compartment', which might be empty (which was later called a "null class") and aimed at the elaboration of a "class calculus", in which all the propositions were treated as asserting the "existence" (in some "universe" or other) or "non-existence" of certain classes denoted by their terms (or the occupation or emptiness of the "compartment"). Venn represented the four familiar types of categorical propositions as:



C. I. Lewis (1883-1964):- Clarence Irving Lewis was an American Philosopher.



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Venn's Diagram: A unique technique of representing categorical propositions by diagrams. John Venn (1834-1923) has devised this technique, so it is named by his name. In Venns diagram only the circles are used.

All x' s are y by x y=0

No x' s are y by x y=0

Some x' s are y by x y = 0

Some x' s are not y by x y = 0

(Where "0" means "different from, or more than, nothing"). But the four traditional types of propositions were not sufficient for a calculus; he regarded it as a legitimate convention for the purpose of his calculus.

The most important contributions towards symbolic logic during the past sixty years have been made by mathematicians. There are a few European Scientists started their research on the foundations of Mathematics. They are Gottlob Frege, Guiseppe Peano, Bertrand Russell and A.N.Whitehead. Russell and Whitehead had explained their method in the form of "Mathematical Logic", "Symbolic Logic" and "Logistics" etc. Symbolic logic and Mathematics are said to be closely related with each other by the use of logical reasoning or arguments in terms of mathematical principles as well as the extensive use of symbols.

The most significant development in symbolic logic was made by the German mathematician Gottlob Frege who formulated predicate calculus and is regarded as the second founder of modern symbolic logic after Boole. The works taken up by Frege and Peano were carried on by the two philosophers A.N.Whitehead and Bertrand Russell. They brought out a work on mathematical logic, entitled in Principia Mathematica. In their works a system of symbolic logic is elaborated and made to serve as the foundation of the whole of mathematics and this whole of mathematics with all its intricacies can be deduced to logic. Russell by his work Principia Mathematica made revolutionary change in logic. Another important philosopher Augustus De Morgan introduced symbols for relations and quantifies predicates. After Principia Mathematica a large number of logical systems of symbolic logic have been developed by different logicians and mathematicians who made a significant contribution to symbolic logic. The first important name in the development of logic from its traditional classical form into its modern symbolic form is G.H.Poh.

Thus, the development of classical logic made modern Logic to develop as a powerful human apparatus. Cohen and Nagel said that classical logic is related to symbolic logic as ''embryo to adult organism''. Thus the contributions of these mathematicians and philosophers have so



Leibnitz* (1646-1716):-** An eminent mathematician and philosopher, born at Leipzig in Germany. He wrote the famous book, 'New Essays Concerning the Human Understanding'.***



A priori: A priori means knowledge that we gain through intellect without experience.

thoroughly incorporated into modern symbolic logic by their more appropriate distinctive ideas.



ACTIVITY: 2.1

- Do you find any remarkable contribution of George Boole which had proved him as the founder father of symbolic logic? Discuss

Ans .....

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- Do you accept that the reformation of logic by the use of different symbols establishes a universal scientific language? Discuss

Ans .....

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2.6 CHARACTERISTICS OF SYMBOLIC LOGIC

As a science Symbolic logic possesses certain characteristics. A distinguished logician C. I. Lewis has mentioned three important general characteristics of Symbolic logic. These are:

- The application of Ideograms
- The application of Deductive Method
- The application of Variables
- **Application of Ideogram instead of Phonogram:** One of the most important characteristics of symbolic logic is the use of symbols. Symbol is the sign artificially designed to stand for something. There are two types of symbols:-ideogram and phonogram. The first basic

characteristic of symbolic logic is the extensive use of ideograms instead of phonogram. Ideograms are those types of symbols which stand directly for the concepts or idea and indirectly for the sound or phone. For example, 'x' (multiplication sign), '-'(subtraction sign), '?'(Question mark) etc. On the other hand phonograms are those symbols which stand directly for the sounds or phones and indirectly for the concept or idea. For example, the written words 'multiplication sign', 'question mark', 'division sign', etc. When these words are uttered, first of all we hear the sound and then we understand the meanings.

- **Application of Deductive Method:** The second basic characteristic of symbolic logic is the use of the deductive method. A deductive method is that in which from a limited number of statements we can produce an indefinite number of other statements and for producing these statements we are to employ a limited number of rules. Deductive method is used in case of demonstrative reasoning as like as mathematics. As symbolic logic employs this method in this respect, it is quite close to mathematics. And therefore, symbolic logic is purely deductive in nature.
- **The application of variables:** The third basic characteristic of symbolic logic is the use of variables. Variable is a type of symbol that can assume any value within a definite range. Aristotle introduced the notion of variable into logic for the first time in a restricted way.

Generally, the meaning of variable is changeable but in symbolic logic variable means a symbol which can stand for anyone of a given range of values. For example, if x y=12

Here, x and y can assume any value within the range of 1, 2, 3, 4, 5, 6…12. And if the value of x is 3, then the value of y is 4 (3x4=12) and if the value of x is 6 then the value of y is 2 (6x2=12) and so on.

Thus, variables are those symbols which do not have any fixed meaning. They may be given any value. There are two types of symbols used in symbolic logic- they are variables (e.g. p, q, r, s, t. etc) and constants (~, .,ν , ⊃ , º). There are some other variables used in symbolic logic

which stand for statements. Propositional logic which is a branch of symbolic logic deals with the logical relationship between the propositions. The small (middle) letters of English Alphabet namely, p, q, r, s, t, etc are the variables which stand for statements. On the other hand constants '~ 'is used for 'not', '. 'is used for 'and', 'v' is used for 'either or' ⊃ ' is used for 'if-then' and 'º' is used for 'if and only if'. All these constants are used to connect more than one simple statement to make a compound proposition. So, they are also known as connectives. But ' ~ ' is not a connective, it is that constant which is used in front of a single statement to make its negation.



CHECK YOUR PROGRESS

Q 4: What are the different names of modern logic?

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Q 5: What are the different characteristics of symbolic logic?

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Q 6: Name the author of Principia Mathematicia

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Q 7: Write two important names of logicians who made great contributions in the developmemt of symbolic logic.

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Q 8: Who is the author of "Dissertiode Arte Combinatoria"

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Q 9: State whether the following statements are true or false:

a) The use of variables is one of the basic characteristics of symbolic logic. (True/False)

b) Ideograms are those type of symbols which stand directly for sound and indirectly for concepts.(True/False)

c) Phonograms are those type of symbols which stand directly for concepts and indirectly for sounds.(True/False)

d) The words 'multiplication sign' ,' question mark', 'substraction sign' etc. are phonograms. (True/False)

2.7 FUNCTIONS AND THE IMPORTANCE OF THE USE OF SYMBOLS IN LOGIC

- **I Necessity or utility of using symbols in Logic:** Logic as a science of reasoning is concerned with the arguments and that arguments contain propositions or statements as their premises and conclusions. The communication of propositions and arguments requires the use of language. But the arguments formulated in any natural language are often difficult to appraise because of their vague and equivocal nature of the words, the ambiguity of their construction, the misleading idioms they may contain, and their pleasing but deceptive metaphorical style etc. To avoid these peripheral difficulties connected with ordinary language, different thinkers have developed specialized symbols (vocabularies). The use of symbols plays a very important role to perform the function perfectly.

  The following are the importance of using symbols in logic:

  - The use of symbols removes certain difficulties of ordinary language: As one of the important functions of logic is to provide methods of testing the validity and invalidity of arguments. But when the arguments are expressed in any ordinary natural language then it becomes very difficult to determine its validity or invalidity. Because sometimes ordinary languages are full of vagueness.
  - The use of symbols helps to exhibit clearly and concisely the form of propositions and arguments: Logic is generally concerned with the validity of arguments. If the arguments are classified and arranged into particular types, the task of testing the validity of such arguments becomes clear. By the use of symbols, the logical form of an argument becomes clear and distinct as a result of which it becomes easy to determine and test the validity of arguments by applying the general rules.

    For example:

If rains are enough, then the crops will be good.

Rains are enough.

Therefore, the crops are good.

The symbolic form of the argument is-

If p then q

p

Therefore, q

- The use of symbols helps to express the generality of logical rules for testing the validity of arguments: There are some specific rules that can be applied to all the arguments of a particular form. If a particular argument of a particular form is valid, then any other argument belonging to that form may be regarded as valid. Thus, the use of symbols expresses the fact that a particular logical rule is applicable to all the arguments of a particular form. This is the generality of logical rule.
- The use of symbols helps us to save Time, Energy, Labour and Thought: The use of symbols in logic is concise and minimizes the exercise of mental labour. The same is true in case of a logical argument. The use of variables and constants removes the ambiguity, indefiniteness, obscurity and other complexities of arguments. It saves time and energy.
- A convenient symbolism helps us to concentrate upon the essential context: The use of symbols makes concepts and techniques clear and distinct. Symbols can make conciseness, clarity and economy of expression in arguments which would be practically unintelligible when they are expressed in ordinary language. Reasoning depends on the abstract relation.
- Symbols enable us to distinguish and keep distinct different meanings: The use of symbols expresses conveniently the concepts and technical terms which are peculiar to logic itself. Symbols like variables and constants help in representing different logical operations. These are some advantages of the use of symbols that

led the logicians to invent some artificial symbolism which are free from the defects of ordinary language. Modern logic fulfills their investigations by the introduction of many more special symbols and symbolism which has become a powerful device (tool) for analysis and deductions through the development of its own technical language. Special symbols are much better adapted to the actual drawing of inferences than ordinary languages. The use of inferences and the evaluation of arguments are greatly facilitated by the adoption of a special logical notation. Thus, Alfred North Whitehead says: "…..***by the aid of symbolism, we can make transitions in reasoning almost mechanically by the eye, which otherwise would call into play the higher faculties of the brain."***(A.N. Whitehead, ***An Introduction To Mathematics,*** Oxford University Press, Oxford, England, 1911)



ACTIVITY: 2.3

- Do you accept that the use of symbols can remove certain difficulties of ordinary language? Discuss

Ans ……..

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CHECK YOUR PROGRESS

Q 10: What is the main function of logic?

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Q 11: What are the two types of symbols used in symbolic logic?

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Q 12: What is symbolic logic? (Answer in about 60 words)

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Q 13: State Whether the following statements are true or false:

a) The use of symbols reduces our mental labour.(True/False)

b) Classical logic has a long history as symbolic logic has a very short history. (True/False)

c) According to Cohen and Nagel, “Classical logic is related to symbolic logic as embryo to adult organism.” (True/False)

d) Classic logic is said to be a joint venture between mathematics and Philosophy. (True/False)



2.8 LET US SUM UP

The main points discussed in this unit are:

- Classical logic is also known as traditional logic or Aristotelian logic.
- Aristotelian propounded traditional logic. So, it is known as Aristotelian logic
- Modern logic is also known as symbolic logic, Mathematical logic, Algebra of logic, Logistics.
- The use of symbols brought about significant change in the traditional logic and the developed form of traditional logic is known as symbolic logic.
- The three important general characteristics of Symbolic logic are: The application of Ideograms, the application of deductive method, the application of variables
- Leibnitz wrote the book- Dissertio de Arte Combinatoria
- A.N. Whitehead and Bertrand Russell wrote the Book *Principia Mathematicia*



2.9 FURTHER READINGS

1) Copy, Irving M.(1997). Symbolic Logic(Fifth Edition). New Delhi: Prentice-Hall of India Private Limited

2) Basson, A.H.,& O'Connor,D.J.(1992) Introduction To Symbolic Logic. Calcutta: Oxford University Press, Walton Street, Oxford

3) Wolf, A.(1976). Text Book Of Logic. Delhi:Surjeet Publications, 7-K, Kolhapur Road, Kamala Nagar

4) Copy, Irving M., & Cohen, Carl.(1990). Introduction To Logic(Eighth Edition). New York. Macmillan Publishing Company

5) Whitehead, A.N.(1911). An Introduction To Mathematics. Oxford, England: Oxford University Press

2.10 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q No 1:

(a) True

(b) True

(c) True

(d) True

(e) True

(f) True

Ans to Q No 2: Aristotle

Ans to Q No 3:

a) Classical logic has a long history whereas symbolic logic has a very short history.

b) In classical logic symbols were used to a limited extent where as in symbolic logic symbols are used extensively.

Ans to Q No 4: Classical logic or Aristotelian logic or traditional logic

Ans to Q No 5:

a) The application of ideograms

b) The application of deductive method

c) The application of variables

Ans to Q No 6: Bertrand Russell and R.N. Whitehead

Ans to Q No 7: George Boole, G. Peano

Ans to Q No 8: Leibnitz

Ans to Q No 9:

(a) True

(b) False

(c) False

(d) True

Ans to Q No 10: The main function of logic is to provide methods of testing the validity and invalidity of arguments.

Ans to Q No 11: Variables and Constants

Ans to Q No 12: Symbolic logic is a developed, refined and mature branch of study which is based on the concepts and techniques used in

Aristotelian logic. The method of symbolic logic is mathematical, deductive and formal in nature. Symbolic logic as a formal logic deals with formal truth not with the material truth of propositions. It is known as 'Mathematical logic', Algebra of logic'. 'Logistics' etc.

Ans to Q No 13:

a) True

b) False

c) True

d) False

2.11 MODEL QUESTIONS

A. Very short Questions

Q 1: Define modern logic? Explain its nature and characteristics?

Q 2: Who is the founder of classical logic?

B. Short Questions (Answer each question in about 150 words)

Q 1: What are the differences between symbolic logic and classical logic? Explain

Q 2: What are the utilities of using symbols in logic? Discuss

Q 3: Explain the different stages of developments in symbolic logic.

C. Write short notes on (Answer each question in about 150 words)

a. Deductive method

b. Variable

c. The history of modern logic

D. Distinguish between (Answer each question in about 300-500words)

a. Ideogram and phonogram

b. Classical logic and modern logic

E. Long Questions (Answer each question in about 300-500 words)

Q 1: Explain the relationship of classical logic and symbolic logic.

Q 2: "Classical logic is related to symbolic as 'embryo to adult organism' Discuss this statement.

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