AL/2024/24/E-I

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2024
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2024
General Certificate of Education (Adv. Level) Examination, 2024

තර්ක ශාස්ත්‍රය හා විද්‍යාත්මක ක්‍රමය I அளவையியலும் விஞ்ஞானமுறையும் I **Logic and Scientific Method I**	**24 E I**	පැය දෙකයි இரண்டு மணித்தியாலம் ***Two hours***

Instructions:

- ✻ *Answer **all** questions.*
- ✻ *Write your **Index Number** in the space provided in the answer sheet.*
- ✻ *Instructions are given on the back of the answer sheet. Follow them carefully.*
- ✻ *In each of the questions **1** to **50**, pick one of the alternatives from* (1), (2), (3), (4), (5) *which is **correct** or **most appropriate** and **mark your response on the answer sheet with a cross** (×) on the number of the correct option in accordance with the instructions given on the back of the answer sheet.*

N.B.

✻ The symbols for the logical constants and operations used in this paper are only as follows. In answering this paper the symbols should be used accordingly.

In the sentential and predicate calculi:

Negation : ~ , Implication : →, Conjunction : ∧ , Disjunction : ∨, Biconditional : ↔

Universal quantifier: Λ, Existential quantifier: V

In class logic:

The class union of A and B: $A \cup B$, class intersection: $A \cap B$ or AB, the complement of A: $\overline{A}$, universe class: U, null class: ϕ

In Boolean algebra:

sum: +, product: ·, the complement of X: $\overline{X}$, values: 1 and 0

In Logic gates:

The AND, OR, NOT, XOR gates for the inputs A and B will be respectively shown by $A \cdot B, A + B, \overline{A}, A \oplus B$

1. In the Aristotelian logical analysis the proposition, 'Thales is the father of Philosophy' is
(1) a particular affirmative proposition.
(2) an universal affirmative proposition.
(3) both a particular affirmative and an universal affirmative proposition.
(4) a proposition the type of which cannot be determined.
(5) a singular proposition.

2. Which of the following is the complement term for 'winner'?
(1) looser (2) Non-winner (3) Non-looser (4) champion (5) player

3. Which of the following is the best term for filling the blank in the sentence 'Psychology is a ... .'?
(1) natural science
(2) social science
(3) natural science and a social science
(4) genetic science
(5) physiological science

[see page two

4. Whose records of astronomical observations of the planets provided the basis of the calculation that led to Kepler's Laws of Planetary Motion?
(1) Isaac Newton (2) Copernicus (3) Tycho de Brahe
(4) Galileo Galilei (5) Ptolemy

5. In the square of opposition the sub-contary relation is between
(1) universal affirmative and universal negative propositions.
(2) universal negative and particular negative propositions.
(3) universal negative and particular affirmative propositions.
(4) universal affiamative and particular affirmative propositions.
(5) particular affirmative and particular negative propositions.

6. According to Francis Bacon scientific investigation begins with
(1) generalized statements. (2) observation. (3) experiment.
(4) measurement. (5) numerical analysis.

7. Given 'some stones are not minerals' is true then its corresponding *A*, *E* and *I* propositions are respectively,
(1) False, Indeterminate, True.
(2) Indeterminate, False, True.
(3) False, True, Indeterminate.
(4) False, Indeterminate, Indeterminate.
(5) True, True, False.

8. The temperature and length are respectively measured through
(1) nominal scale and ordinal scale.
(2) ordinal scale and ratio scale.
(3) ratio scale and nominal scale.
(4) interval scale and nominal scale.
(5) interval scale and ratio scale.

9. Which of the following sequence of propositions obtains in reaching of an inversion of an universal negative proposition?
(1) *E*, *A*, *I*, *E* (2) *E*, *E*, *A*, *I* (3) *E*, *A*, *I*, *O*
(4) *E*, *I*, *A*, *O* (5) *E*, *E*, *I*, *O*

10. What is the basis of Classical Mechanics?
(1) Hubble's Law of Cosmic Expansion
(2) Einstein's General Theory of Relativity
(3) Newton's Laws of Motion and his Law of Gravitation
(4) Galileo's Law
(5) Kepler's Laws of Planetary Motion

11. "Nothing happens without a sufficient reason, that is, nothing happens without its being possible for one who should know things sufficiently to give a reason showing why things are so and not otherwise."
Who is associated with the above Law?
(1) Aristotle (2) Leibniz (3) Plato (4) Locke (5) Euclid

12. What is the conception of light in contemporary science?
(1) waves
(2) particles
(3) photons
(4) modification of gravitational force
(5) beta rays

[*see page three*

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13. Which of the following two propositions have existential import in modern logic?
(1) *A* and *O* (2) *E* and *O* (3) *A* and *E* (4) *I* and *O* (5) *A* and *I*

14. Which of the following gives the mean and median respectively of the sequence of numbers 1, 3, 5, 6, 7?
(1) 4.4 and 4.6 (2) 4.4 and 5 (3) 4.8 and 5.3 (4) 4.8 and 6 (5) 5.3 and 4.4

15. All humans are selfish.
No apes are humans.
Therefore no apes are selfish.
The above argument commits the fallacy of
(1) undistributed middle.
(2) illicit major.
(3) illicit minor.
(4) fallacy of two negative premises.
(5) fallacy of four terms.

16. Which set of three of the following precedes the emergence of modern science?
(1) Printing machine, microscope and telescope
(2) Compass, gunpowder and telescope
(3) Gunpowder, compass and printing machine
(4) Steam engine, compass and microscope
(5) Gunpowder, compass and steam engine

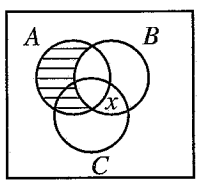
17. Two of the valid moods of third figure are
(1) *DARII* and *FESTINO*. (2) *DIMARIS* and *BAROCO*.
(3) *DATISI* and *DARAPTI*. (4) *CAMINOS* and *DARII*.
(5) *FESEPO* and *FESTINO*.

18. With whom among the following scientists is the view that 'acquired traits could be inherited' associated?
(1) Erasmus Darwin (2) Herbert Spencer (3) Charles Darwin
(4) Lamarck (5) Gregor Mendel

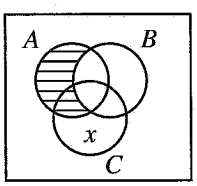
19. What is the minimum number of rules of inference needed to prove the following theorem: $(P \vee \sim P)$?
(1) One (2) Two (3) Three (4) Four (5) Five

20. After seeing Rosalind Franklin's X-ray Diffraction photographs, James Watson guessed the structure of the DNA as
(1) parabola shaped. (2) spiral shaped. (3) helix shaped. (4) oval shaped. (5) ellipse shaped.

21. Which of the following diagrams satisfy $A\overline{B}=\phi$, $x \in (A \cap B)$ and $x \in C$?



(1)



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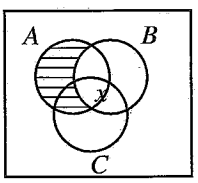

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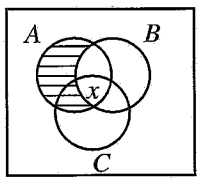

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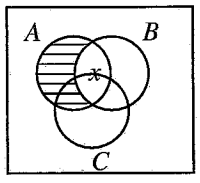


(5)

22. In how many ways can a set of three cards be drawn from a pack of 52 playing cards?
(1) 23157 (2) 21000 (3) 22100 (4) 18400 (5) 20100

[*see page four*

23. Which of the following is a logical theorem?

(1) $((P \wedge Q) \rightarrow R) \leftrightarrow (P \rightarrow (Q \rightarrow R))$

(2) $((P \rightarrow Q) \rightarrow (R \rightarrow S)) \rightarrow ((Q \rightarrow R) \rightarrow S)$

(3) $((P \rightarrow Q) \rightarrow R) \rightarrow (\sim R \rightarrow P)$

(4) $(\sim P \vee \sim Q) \wedge (\sim P \vee Q) \rightarrow (\sim P \leftrightarrow \sim Q)$

(5) $((R \wedge \sim Q) \rightarrow R) \rightarrow ((R \rightarrow Q) \rightarrow \sim S)$

24. 'Oxford University produces the best post-graduates in the United Kingdom. Therefore, any post-graduate from Oxford is better than any post-graduate from any other university in UK.' What is the Fallacy committed in the above passage?

(1) Fallacy of composition
(2) Fallacy of division
(3) Fallacy of post hoc ergo propter hoc
(4) Appeal to the force
(5) Appeal to the people

25. 'A triangle does not have three angles.' This statement is

(1) tautological. (2) self-contradictory. (3) paradoxical.
(4) an analytical truth. (5) an ambiguity.

26. Why do social scientists strive to express the collected qualitative information in quantitative mode?

(1) To facilitate data collection
(2) For the benefit of the public
(3) To make the research cost fall within the budgetary provision
(4) To compare previous qualitative information of the research with current data
(5) As quantization facilitates the summarization of the data in a large of sample and enables the use of quantitative techniques in analysis and presentation

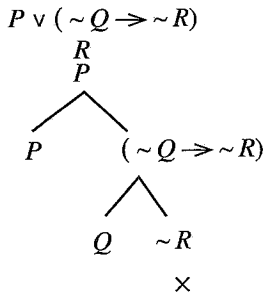
27. What is the correct truth tree of the following argument?

$P \vee (\sim Q \rightarrow \sim R)$

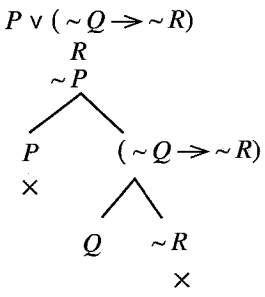
R

$\therefore P$

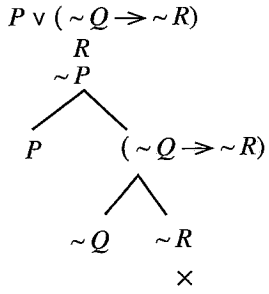
(1)



(2)



(3)



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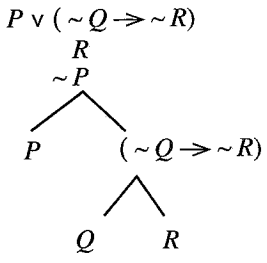
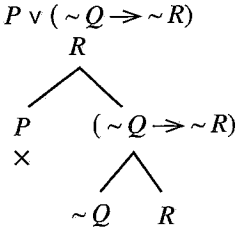


(5)



[see page five

28. Which of the following pairs is logically equivalent?

(1) $(P \rightarrow Q)$, $(P \wedge Q)$

(2) $(\sim P \wedge Q)$, $(P \vee \sim Q)$

(3) $(\sim P \rightarrow \sim Q)$, $(P \wedge Q)$

(4) $\sim(P \wedge Q)$, $(P \wedge Q)$

(5) $\sim(P \wedge Q)$, $(\sim P \vee \sim Q)$

29. Which of the following is the reason that makes Karl Popper claim that 'Marxism is a non-science'?

(1) Historical determinism is a main feature of Marxism.

(2) Marxism is not a natural science.

(3) Marxism does not give novel predictions.

(4) Marxism is not philosophically respectable.

(5) Marxism has sometimes been interpreted and/or modified to make it non falsifiable.

30. Which couple of the following operations is associated with Boolean algebra?

(1) implication and multiplication

(2) multiplication and addition

(3) implication and addition

(4) addition and simplification

(5) multiplication and simplification

31. In which of the following sets do both thinkers make contributions to the view that 'understanding of social world is an interpretative effort'?

(1) Comte and Dilthey

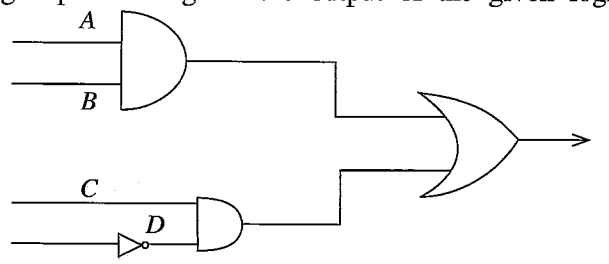
(2) Marx and Durkheim

(3) Weber and Dilthey

(4) Gustav Schmoller and Karl Menger

(5) Durkheim and Engels

32. Which of the following expressions gives the output of the given logic gate?



(1) $(A.B).(C+\overline{D})$

(2) $(A.B).(C.D)$

(3) $(A.B)+(C.\overline{D})$

(4) $(A+B).(C.\overline{D})$

(5) $(A.B)+(C.D)$

33. Which of the following factors should **not** enter consideration in the formulation and conduct of pre election polls and forecasts?

(1) The sampling of the voters should accurately reflect the relevant groupings of population.

(2) The investigative group should be unbiased.

(3) The forecasts of the poll could affect the population.

(4) The sample should not be too large, so that the poll budget could not afford the expenses.

(5) The sample should be numerically adequate.

[*see page six*

34. Which of the following is the correct truth tree for the symbolization?

$\Lambda x \sim (Gx \longrightarrow \sim Fx) \bullet Vx\,(Fx \wedge Hx) \therefore Vx\,(Fx \vee Hx)$

(1)

$\Lambda x \sim (Gx \longrightarrow \sim Fx)$
$Vx\,(Gx \wedge Hx)$
$\sim Vx\,(Fx \vee Hx)$
$\Lambda x \sim (Fv \vee Hx)$
Ga
Ha
$\sim (Ga \longrightarrow \sim Fa)$
$\sim (Fa \vee Ha)$
$\sim Fa$
$\sim Ha$
$\sim (Ga \longrightarrow \sim Fa)$
$Ga \times$
$Fa \times$

(2)

$\Lambda x \sim (Gx \longrightarrow \sim Fx)$
$Vx\,(Gx \wedge Hx)$
$\sim (Vx\,(Fx \vee Hx)$
$Fa \quad Ga$
$\sim (Ga \longrightarrow \sim Fx)$
$\sim Ga \vee Ha$
Ga
$\sim Ha$
$\sim (Ga \longrightarrow \sim Fa)$
$\sim Ga$
$\sim Fa$

(3)

$\Lambda x \sim (Gx \longrightarrow \sim Fx)$
$Vx\,(Fx \wedge Hx)$
$\sim Vx\,(Fx \vee Hx)$
Fa
Ga
$\sim (Ga \longrightarrow \sim Fa)$
$(\sim Ga \vee Ha)$
Ga
$\sim Ha$
$\sim (Ga \longrightarrow \sim Fa)$
Ga
$\sim Fa \times$

(4)

$\Lambda x \sim (Gx \longrightarrow \sim Fx)$
$Vx\,(Fx\,Hx)$
$\sim Vx\,(Fx \vee Hx)$
$\Lambda x \sim (Fx \vee Hx)$
Fa
Ga
$\sim (Ga \longrightarrow \sim Fa)$
$\sim (\sim Ga \vee Ha)$
Ga
Ha
$\sim (Ga \longrightarrow \sim Fa)$
$\sim Ga \times$
$\sim Fa$

(5)

$\Lambda x \sim (Gx \longrightarrow \sim Fx)$
$Vx\,(Gx \wedge Hx)$
$\sim Vx\,(Fx \vee Hx)$
$Fa \quad Ga$
$\sim (Ga \longrightarrow \sim Fa)$
Ga
$\sim Ha$
$\sim (Ga \longrightarrow \sim Fa)$
Ga
$\sim Fa$

35. "What happens when transition is made from a restricted theory T^1 to a wider theory T... is something much more radical than incorporation of the unchanged Theory T^1 into the wider context of T. What happens is rather a complete replacement of T^1 by the ontology of T and a corresponding change in the meanings of all descriptive terms of T^1..."
Who writes the above statement?

(1) Thomas Kuhn
(2) Russell Hanson
(3) Imre Lakatos
(4) Paul Feyerabend
(5) Karl Popper

36. Which of the following arguments is invalid?

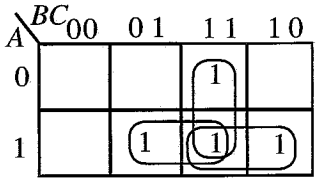
(1) $(P \rightarrow Q) \cdot (P \wedge R) \therefore Q$
(2) $(P \wedge Q) \cdot (P \rightarrow R) \therefore (R \wedge S)$
(3) $(P \wedge Q) \cdot ((Q \vee R) \rightarrow S) \therefore S$
(4) $(P \wedge \sim Q) \cdot (\sim Q \rightarrow \sim R) \therefore (\sim R \wedge P)$
(5) $(P \vee Q) \cdot (P \rightarrow R) \cdot \sim R \therefore Q$

37. "A gas consists of a huge number of freely moving particles, molecules and atoms in constant motion with different velocities which change when particles collide."
The above statement is associated with

(1) Boyle's Law.
(2) Charles' Law.
(3) Kinetic Theory of Gases.
(4) Galileo's Law.
(5) Guy-Lussac's Law.

[see page seven

38. Select the option which indicates the correct output of the given K-map.



(1) $AB + B\overline{C} + AC$ (2) $\overline{A}B + A\overline{C} + BC$

(3) $AB + BC + AC$ (4) $BC + \overline{A}\,\overline{B} + AC$

(5) $AB + BC + A\overline{C}$

39. Several thought experiments made significant impact for the advancement of physics. Select from below a test which is **not** a thought experiment at the time it was presented?

(1) The experiment which is known as 'Schrodinger's cat'

(2) Galileo's experiment of comparison of the fall of tiles of equal weight tied together by a weightless string with that of the fall of one of those tiles

(3) Einstein's 'Twin Paradox' test which deals with the 'age gap' between twins

(4) Arthur Eddington's experiment on light with observation of the motion of light from a star at a solar eclipse as a test of relativity

(5) The experiment mentioned by Newton about a projectile on earth extending to be moving in an orbit like the orbit of the moon

40. Using the scheme of abbreviation, F : a is philosopher, G : a is seeking wisdom, the symbolization of 'All philosophers seek wisdom and only philosophers seek wisdom' is,

(1) $\Lambda x\,(Fx \wedge Gx) \wedge \Lambda x\,(Gx \rightarrow Fx)$ (2) $\Lambda x\,(Fx \rightarrow \sim Gx) \wedge \Lambda x\,(Fx \rightarrow Gx)$

(3) $\Lambda x\,(Fx \rightarrow Gx) \wedge \Lambda x\,(Gx \rightarrow Fx)$ (4) $\Lambda x\,(Gx \wedge Fx) \wedge Vx\,(Gx \rightarrow Fx)$

(5) $Vx\,(Fx \wedge Gx) \wedge \Lambda x\,(Gx \rightarrow Fx)$

41. Which of the following scientists was awarded Nobel prize for Chemistry for the discovery of Polonium?

(1) Max Planck (2) Marie Curie (3) Niels Bohr

(4) Ernest Rutherford (5) Linus Pauling

42. What is the purpose of a suspended sentence given in a court of Law?

(1) The person who is punished could freely engage in any unlawful activities.

(2) The person who is punished could not engage in any unlawful activity during the suspended period.

(3) The person who is punished will be given the punishment after the suspended period.

(4) The person who is punished might get a pardon in future.

(5) The person who is punished could not make any appeal.

43. According to Lakatos, Newtonian mechanics in the 18th century was a progressive research programme because;

(1) Newton used the same words with different meanings in different areas in physical science.

(2) Newtonian mechanics made novel predictions in the programme.

(3) Newtonian mechanics developed anomalies which were not solved.

(4) Newtonian mechanics led to developments in the study of light.

(5) Newtonian mechanics was used in the study of electromagnetism.

44. *A* : Mahadanamutta cannot solve all the problems.
B : Mahadanamutta cannot solve any problem.
What is the logical relationship between the above statements?

(1) They are logically equivalent.

(2) They are logically non-equivalent.

(3) The sentence *A* implies sentence *B*.

(4) The Sentence *B* implies sentence *A*.

(5) Logically contradictory.

[see page eight

45. "... there is a revealing logical lacuna in the positivist argument... can Newtonian dynamics really be derived from relativistic dynamics?...
... the derivation is spurious... the physical referents of the Einsteinian concepts are by no means identical with those of the Newtonian concepts that bear the same name (Newtonian mass is conserved; Einsteinian is convertible with energy...)."
(Thomas Kuhn, **The Structure of Scientific Revolutions**, pp. **101-2**)
What is Kuhn arguing against in this passage?
(1) Explanation of Newtonian theory by Einsteinian theory
(2) Comparison of Classical science and Relativistic science
(3) Reduction of theories in science
(4) Replacement of realism with positivism
(5) Application logical principles in science

46. The omnipotent God could create a stone which he himself cannot lift.'
This statement is
(1) an analytical statement.
(2) a self contradiction.
(3) a necessary truth.
(4) a posteriori statement.
(5) a tautological statement.

47. An explanation in terms of a target is known as
(1) Functional explanation
(2) Causal explanation
(3) Probabilistic explanation
(4) Teleological explanation
(5) Ontological explanation

48. All cats are animals. Therefore some cats are animals.
According to modern and Aristotalean views, the given argument is respectively
(1) Valid, Valid.
(2) Valid, Invalid.
(3) Invalid, Invalid.
(4) Invalid, Valid.
(5) Indeterminate, Indeterminate.

49. Which of the following thinkers held the view that atoms are non-existent?
(1) John Dalton (2) Democritus (3) Ernest Mach (4) Neils Bohr (5) Max Planck

50. A fundamental principle in the medical code of conduct is
(1) 'be generous to patients.'
(2) 'will do no harm to patients.'
(3) 'serve the public.'
(4) 'do not involve in non-medical services.'
(5) 'engage in medical research.'

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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2024
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2024
General Certificate of Education (Adv. Level) Examination, 2024

තර්ක ශාස්ත්‍රය හා විද්‍යාත්මක ක්‍රමය II அளவையியலும் விஞ்ஞானமுறையும் II **Logic and Scientific Method II**	**24 E II**

පැය තුනයි மூன்று மணித்தியாலம் ***Three hours***	අමතර කියවීම් කාලය - මිනිත්තු 10 යි மேலதிக வாசிப்பு நேரம் - 10 நிமிடங்கள் **Additional Reading Time - 10 minutes**

Use additional reading time to go through the question paper, select the questions you will answer and decide which of them you will prioritise.

Instructions:

* *Number of questions that should be answered – **06***
* *The question in the **Part I** is compulsory.*
* *In addition answer **five** questions selecting **at least two** questions from each of the **Parts II** and **III**.*

N.B.

* The symbols for the logical constants and operations used in this paper are as following. In answering this paper, the symbols should be used accordingly.

In the sentential and predicate calculi:

Negation: $\sim$, Implication: $\rightarrow$, Conjunction: $\wedge$, Disjunction: $\vee$, Biconditional: $\leftrightarrow$

Universal quantifier: $\wedge$, Existential quantifier: $\vee$

In class logic:

The class union of classes A and B: $A \cup B$, class intersection: $A \cap B$ or AB, the complement of A: $\bar{A}$, universe class: U, null class: ϕ

In Boolean algebra:

sum: +, product: $\cdot$, the complement of X: $\bar{X}$, values : 1 and 0

In Logic gates:

The AND, OR, NOT, XOR gates for inputs A and B will be respectively shown by $A \cdot B$, $A + B$, $\bar{A}$, $A \oplus B$

* The candidates are advised **not** to use any other symbols for logical constants or operations.
* The candidate should **not** use theorems (e.g. De Morgan theorem)in derivations except when the theorem itself has been proved by the candidate.

Part I

1. (i) What is the subcontrary of the proposition, 'Some Egyptian queens were not Greeks.'?

(ii) What are in order, the most appropriate terms to fill in the blanks in the following statement?

"Neo-Darwinism or modern theory of life-transformation is operated by Darwinian natural ... acting on a Mendelian ... principled self-reproducing and self-varying genes."

(iii) Write the term which fills the blank most appropriately in the following proposition.

"A term is ... in any proposition if reference is made to every member of the class for which the term stands."

(iv) Is the following statement true or false.

With the standard use of material implication the conclusion of a valid argument with false premises cannot be true.

[*see page two*

(v) State the term which is appropriate to fill in the blank.

In standard natural scientific methodology, a theory explains a phenomena if the occurrence of the phenomena is ... from the theory plus, initial conditions and auxiliary hypotheses.

(vi) If A, B are classes then if $A \cup B$ =A and $A \cap B = \phi$, then what is the class B?

(vii) Why does Karl Popper think that he evades the problem of justification of induction in his methodology?

(viii) What is a Boolean variable?

(ix) "Scientific knowledge like language, is intrinsically the common property of a group or is nothing at all."

Who is the outstanding historian and methodologist of science who, writing passages like the above in the mid-20th century emphasized the community structure of science?

(x) As what civilization is that characterised by the system of streams or canals and cascades of tanks in the dry zone of Sri Lanka known?

(02 × 10 = 20 marks)

Part II

2. (*a*) Explain clearly the difference between contradictory terms and contrary terms, giving examples. *(04 marks)*

(*b*) Discuss the issues that arise for the relations between propositions in the traditional square of opposition when the contemporary distinction between existential and non-existential interpretation is applied there. *(04 marks)*

(*c*) Describe the three types of syllogism in traditional logic, giving examples. *(04 marks)*

(*d*) (i) What is the form of Aristotelian sorites? *(02 marks)*

(ii) What are enthymemies? *(02 marks)*

3. (*a*) Determine, whether the following syllogisms are valid or invalid, using the rules of the traditional syllogism.

Some flowers are not beautiful. All flowers are expensive things.

Therefore all expensive things are beautiful. *(04 marks)*

(*b*) By the rules of the syllogism, show that 'if the major premise of a syllogism is particular, its minor premise cannot be negative.' *(04 marks)*

(*c*) Symbolize the following argument in terms of classes and determine its validity using Venn diagrams.

All rabbits run fast and so do some horses. Therefore some horses are rabbits. *(04 marks)*

(*d*) Explain the nature of the concepts

(i) universe of discourse *(02 marks)*

(ii) null class *(02 marks)*

4. (*a*) Prove the following theorems by derivation.

(i) $(P \rightarrow Q) \leftrightarrow \sim (P \wedge \sim Q)$

(ii) $(P \rightarrow Q) \rightarrow ((P \vee R) \rightarrow (Q \vee R))$ *(02 × 2 = 04 marks)*

(*b*) Symbolize the following argument and test for its validity by the indirect truth table method.

Although Rama is not an outstanding batsman he was lucky. Luck helps in cricket and he became a centurion. If he is a centurion he plays for the world cup. Therefore, if luck helps in cricket, then Rama plays for the world cup, if either he was lucky or he is an outstanding batsman. *(04 marks)*

[*see page three*

(*c*) Symbolize the following argument and show it to be valid by derivation.

Only men can make aeroplanes.
Whales are not men.
Therefore whales cannot make aeroplanes.

Use the SA,
F : a man
G : a makes aeroplanes
H : a is a whale

(04 marks)

(*d*) Test the validity of the following arguments by the method of truth trees.

(i) If logic is easy then Mathematics is easy. If mathematics is easy then Physics is easy; If Physics is easy then there are many Einsteins. But there are not many Einsteins. Therefore logic is not easy. *(02 marks)*

(ii) All Sri Lankans are rich.
Some Sri Lankans are not tax payers.
Therefore those who are rich are not tax payers. *(02 marks)*

5. (*a*) (i) In which algebra are the two relations $\bar{1} = 0$ and $\bar{0} = 1$ as well as $x+1 = 1$, where x is a variable, are laws? *(02 marks)*

(ii) State the **three** Boolean operators. *(02 marks)*

(iii) What operators are indicated by the symbols '–' and '+' in (i) above? *(02 marks)*

(iv) What is the Boolean operator **not** used in (i) above? How is it symbolized? *(02 marks)*

(*b*) (i) Simplify the following Boolean expression giving your steps.

$$\bar{A}BC + A\bar{B}\bar{C} + \bar{A}\bar{B}\bar{C} + A\bar{B}C + ABC$$

(02 marks)

(ii) Draw the K-map of the resultant expression in the above simplification. *(02 marks)*

(*c*) Find a Boolean expression equivalent to (A↔B) having 'AND' as nucleus of the expression and draw a logic gate of it. *(04 marks)*

6. (*a*) Identify the fallacies in the following passages and outline how these occur.

(i) Internationally known nuclear scientist 'X' has said brown eggs are a necessary component of your daily diet. Therefore our daily meal should include brown eggs.

(ii) As the plane took off thunder was heard in the sky. Therefore the plane crashed because of the thunder at the take off.

(iii) The Sri Lankan cricket team has a good reputation. Therefore Sri Lankan cricketer 'X' has a good reputation.

(03 × 3 = 09 marks)

(*b*) (i) Write a note on "Capital Punishment - Yes or No?" *(04 marks)*

(ii) In what type of case does a court of law want to be proved beyond reasonable doubt? *(03 marks)*

[*see page four*

Part III

7. (*a*) "In post-Renaissance Europe, it was Galileo, and not Francis Bacon, who actually combined the methods of the scholar and the craftsman to begin modern science and lay its methodological foundations." Make a case for this statement. *(10 marks)*

(*b*) Outline the salient features of Bacon's inductivist methodology. *(06 marks)*

8. (*a*) 'The language of contemporary science is the languages of instruments.' Discuss taking examples from science, how and why instruments have become so dominant and indispensable in contemporary scientific research. *(06 marks)*

(*b*) "Analogy and models have played a key role both in the thinking and actual practice in the development of scientific knowledge from its inception to this day" Elucidate taking examples. *(06 marks)*

(*c*) What is

(i) functional explanation

(ii) causal explanation

(02 × 2 = 04 marks)

9. (*a*) (i) What is weighted mean? How is it obtained and why is it necessary? *(03 marks)*

(ii) Distinguish between random sampling and stratified sampling. What criteria go to choosing between them? *(04 marks)*

(*b*) 'Social scientific prediction is mostly projection' Explain and comment. *(04 marks)*

(*c*) 'Social scientific theory helps to make one understand phenomena, but they cannot explain them'. Discuss this controversy. *(05 marks)*

10. (*a*) Compare and contrast the features of the logical empiricist verificationist methodology of Carl Hempel with the falsificanist methodology Karl Popper. *(08 marks)*

(*b*) "Kuhn and Feyerabend revolutionized and relativised the methodology of science." What were the dominant common factors and features of their account of methodology? *(08 marks)*

11. Write notes on **four** of the following

(i) UNO - are limitations beating its purpose?

(ii) State and Religion

(iii) Social media - liberator or gossip monger

(iv) Media ethics

(v) Cyber crimes

(vi) Alternate systems of knowledge

(04 × 4 = 16 marks)

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