# UNIVERSITY COLLEGE LONDON

University of London

## EXAMINATION FOR INTERNAL STUDENTS

For The Following Qualifications:-

*B.A.* *B.Sc.* *B.Sc.(Econ)M.Sci.*

**Philosophy B1: Logic**

| | | |
|---|---|---|
| COURSE CODE | : | **PHILB001** |
| UNIT VALUE | : | **1.00** |
| DATE | : | **09-MAY-05** |
| TIME | : | **10.00** |
| TIME ALLOWED | : | **3 Hours** |

05-C1032-3-40


**TURN OVER**

B1 LOGIC 2005

Answer all questions

All questions have equal value

## PART A. BASIC LOGICAL NOTIONS

1. What does it mean to say that sentences are logically equivalent? Can two false sentences be logically equivalent? If they can, give an example. If they can't, explain why not.
2. If a premise of an argument is logically equivalent to the conclusion, what, if anything, can you conclude from this about the validity of the argument? Explain your answer.
3. 'Any two sentences which are logically equivalent are also logically consistent.' Is this statement true? Explain your answer.

## PART B. SYMBOLISATION IN SL

Translate the following sentences into SL using the symbolisation key provided:

| | |
|---|---|
| A: Anna's experiment is successful. | N: Anna will win a Nobel Prize. |
| B: Bruce's experiment is successful. | P: Bruce will win a Nobel Prize. |
| E: Anna's equipment is faulty. | S: Anna's equipment has been sabotaged. |

4. If both Anna's and Bruce's experiments are successful, then neither will win the Nobel Prize.
5. Anna will not win the Nobel Prize unless her experiment is a success.
6. Anna's experiment will only be a success if her equipment is neither faulty nor has been sabotaged.
7. Even if Anna's equipment is not faulty, Bruce will win the Nobel Prize if his experiment is successful.

## PART C. SYNTAX AND SEMANTICS OF SL

8. Can the sentence 'Anna will not win the Nobel Prize because her equipment is faulty and has been sabotaged' be translated into SL with the key given in Part B? If it can, give a translation. If it cannot, explain why not and say how it could be translated.
9. Define what it means for the system of SL to be (i) sound and (ii) complete and briefly explain the significance of these results for the ways in which an argument can be shown to be valid.
10. Use the long or short truth table method to determine whether the argument

$$\begin{array}{l} \sim\sim(R \equiv \sim Q) \\ \underline{P \vee \sim(Q \,\&\, R)\qquad\quad} \\ P \supset (\sim Q \vee \sim R) \end{array}$$

is truth-functionally valid. Explain your answer.

CONTINUED

PART D. DERIVATIONS IN SENTENTIAL LOGIC

Show by deduction that the following derivability claims hold:

11. $\sim M \equiv L, \sim M \supset N, K \supset \sim N \vdash \sim(K \,\&\, L)$

12. $(P \,\&\, \sim R) \supset \sim P, (Q \,\&\, \sim R) \supset \sim Q \vdash (P \vee Q) \supset R$

13. $\vdash J \supset (\sim H \supset (J \vee K))$

PART E. SYMBOLISATION IN PREDICATE LOGIC

Symbolise in Predicate Logic with Identity, using the following key:

Domain: People

Oxy: x is older than y          a: Albert

Mxy: x is the mother of y

14. Albert's mother is older than he is.
15. Everyone's mother is older than they are.
16. Everyone has exactly one mother.
17. Not everyone has the same mother.

PART F. SYNTAX AND SEMANTICS OF PREDICATE LOGIC

18. What is the most satisfactory translation into PLI of the sentence 'Pegasus is a flying elephant.'? Briefly explain your answer. What are the *two* best translations into PLI of 'Pegasus is not a flying elephant.'?
19. Define an equivalence relation and state its defining properties in terms of Predicate Logic (using Rxy: x is related to y). Give an example in English of an equivalence relation.
20. Provide an interpretation to show that the following argument is quantificationally invalid:

$$\frac{(\forall x)\,(\forall y)\,(\forall z)[(Sxy \supset Syz) \supset Sxz]}{(\forall x)\,(\forall y)\,(Sxy \supset Syx)}$$

PART G. DERIVATIONS

Show that the following derivability claims hold in Predicate Logic:

21. $(\forall x)\,(x = a \supset \sim Fx), Fb \vdash \sim a = b$

22. $(\forall x)\,(Px \supset (\exists y)(Qyx \,\&\, Ry)), (\forall x)\,Px \vdash (\exists x)\,Rx$

23. $(\forall x)\,(\forall y)\,(Gxy \supset Hy), (\exists x) \sim Hx \vdash (\exists x)(\exists y) \sim Gxy$

END OF PAPER