

2001 Paper 5 Question 11

Logic and Proof

- (a) Explain the meaning of the notation $A \models B$, where A and B denote formulae of (i) propositional logic and (ii) S4 modal logic. [2+6 marks]
- (b) For each of the following equivalences, state whether it holds or not, justifying each answer rigorously.

$$\begin{aligned}(P \wedge (Q \rightarrow R)) \rightarrow S &\simeq (\neg P \vee \neg Q \vee S) \wedge (\neg P \vee \neg R \vee S) \\(P \rightarrow Q) \rightarrow (Q \rightarrow P) &\simeq (Q \rightarrow P) \\ \forall xy (P(x) \vee \neg P(y)) &\simeq \forall xy (P(x) \leftrightarrow P(y))\end{aligned}$$

[3+3+6 marks]