**COMPUTER SCIENCE TRIPOS Part IB – 2026 – Paper 6**

## 1 Complexity Theory (tg508)

Let $A \leq_p B$ denote polynomial-time many-one reducibility.

(*a*) Define $A \leq_p B$. What does it mean for a language to be NP-complete? [2 marks]

(*b*) Define K-SAT and show that 2SAT$\in$ P. [4 marks]

(*c*) VERTEX-COVER is defined as follows: given a graph $G = (V, E)$ and integer $k$, decide whether there exists $S \subseteq V$ with $|S| \leq k$ such that every edge has at least one endpoint in $S$. Prove that VERTEX-COVER$\in$ NP. [2 marks]

(*d*) Give a polynomial-time reduction from 3SAT to VERTEX-COVER, and prove its correctness. [8 marks]

(*e*) Define INDEPENDENT-SET and prove that it is NP-complete by giving a polynomial-time reduction from VERTEX-COVER. [4 marks]