FORMULAE SHEET FOR INF1003 MATHEMATICS I

LOGICAL EQUIVALENCES – CONDITIONAL AND BICONDITIONAL STATEMENTS

$p \to q \equiv \neg p \vee q$	$p \leftrightarrow q \equiv (p \to q) \wedge (q \to p)$
$p \to q \equiv \neg q \to \neg p$	$p \leftrightarrow q \equiv \neg p \leftrightarrow \neg q$
$p \vee q \equiv \neg p \to q$	$p \leftrightarrow q \equiv (p \wedge q) \vee (\neg p \wedge \neg q)$
$p \wedge q \equiv \neg(p \to \neg q)$	$\neg(p \leftrightarrow q) \equiv p \leftrightarrow \neg q$
$\neg(p \to q) \equiv p \wedge \neg q$	

RULES OF INFERENCE – PROPOSITIONAL LOGIC

Modus ponens	p $p \to q$ $\therefore q$	Hypothetical syllogism	$p \to q$ $q \to r$ $\therefore p \to r$	Addition	p $\therefore p \vee q$	Conjunction	p q $\therefore p \wedge q$
Modus tollens	$\neg q$ $p \to q$ $\therefore \neg p$	Disjunctive syllogism	$p \vee q$ $\neg p$ $\therefore q$	Simplification	$p \wedge q$ $\therefore p$	Resolution	$p \vee q$ $\neg p \vee r$ $\therefore q \vee r$

RULES OF INFERENCE – PREDICATE LOGIC

Universal instantiation	$\forall x P(x)$ $\therefore P(c)$
Universal generalization	$P(c)$ for an arbitrary element c $\therefore \forall x P(x)$
Existential instantiation	$\exists x P(x)$ $\therefore P(c)$ for some element c
Existential generalization	$P(c)$ for some element c $\therefore \exists x P(x)$

ARITHMETIC SERIES

Sequence formula of n^{th} term	$a_n = a + (n-1)d$
Series formula for the sum of n terms	$S_n = \frac{n}{2}[2a + (n-1)d]$

GEOMETRIC SERIES

Sequence formula of n^{th} term	$a_n = ar^{n-1}$
Series formula for the sum of n terms	$S_n = \frac{a(1-r^n)}{(1-r)}$
Series formula for the sum of infinite terms	$S_\infty = \frac{a}{(1-r)}$ when $\lvert r \rvert < 1$

COMBINATION AND PERMUTATION

Combination	$C(n,r) = \frac{n!}{r!\,(n-r)!}$
Permutation	$P(n,r) = \frac{n!}{(n-r)!}$