

# **THE UNIVERSITY OF QUEENSLAND**

## **School of Information Technology and Electrical Engineering**

Mid-Semester Examination, **TEST EXAM**

### **ELEC2004**

Circuits, Signals and Systems

Time: **FIVE** minutes for perusal  
(during which you may write on question sheet)  
**FOURTY FIVE** minutes for working

**ANSWER WHOLE QUESTION IN ANSWER BOOKLET:  
Total 20 Marks**

**This examination is open book. Any books, handwritten notes, and drawing instruments are allowed.**

**An EAIT faculty approved calculator (with label), or a casio FX-82 series calculator is allowed.**

**Explanations of steps used are essential and will be carefully accounted for in assessment. Best marks are awarded to numerically correct solutions, but partial credit will be given to partially complete solutions, or incorrect solutions where errors have been carried through the calculations.**

1. Consider the circuit below. At time  $t=0$ , the switch moves from position A to position B. The circuit is in steady state up to the time the switch moves.

(a)  $V_{op}$  is the voltage at the output of the opamp with respect to ground. Derive an expression for  $V_{op}$  in terms of the DC voltage source  $V_1$  and the DC current source  $I_1$ .

(4.5 Marks)

(b) If  $V_1=4V$  and  $I_1=5mA$ , what is  $V_{op}$  at time  $t=0^-$  (immediately before the switch opens)?

(0.5 Marks)

(c) By deriving the differential equation, and applying the differential operator  $s$ , find the voltage across the inductor,  $V_x$ , at time  $t=25ms$ .

(15 Marks)

