PH3104 class test 4

Full marks : 20 **Time : 50 minutes**

Q 1) a) By using De Morgan's laws prove the Boolean identity

$$\overline{A \cdot B + B \cdot C + C \cdot A} = \overline{A} \cdot \overline{B} + \overline{B} \cdot \overline{C} + \overline{C} \cdot \overline{A}$$

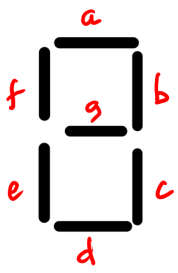
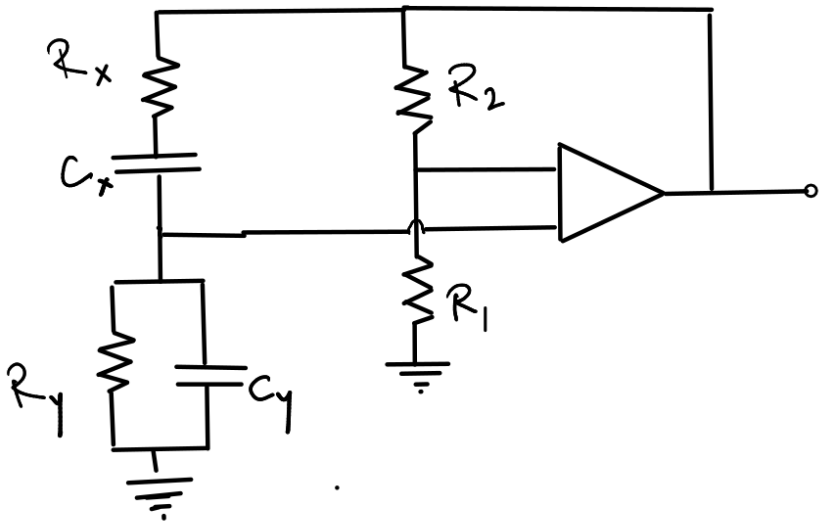


Figure 1: The seven segment display

b) Use the Karnaugh map technique to write down the simplest form of the Boolean function which implements the segment marked **e** in a seven segment display. Choose the don't care conditions wisely!

Implement this Boolean function using NAND gates alone. $[2 + (3 + 3)]$

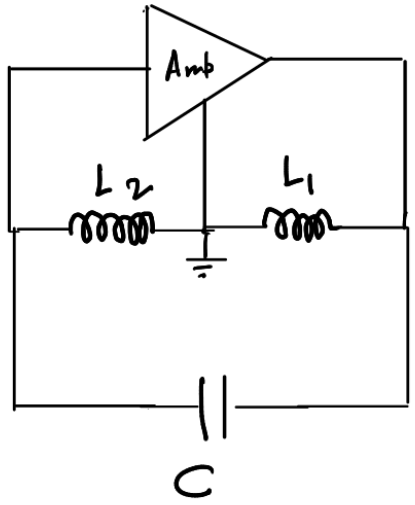
Q 2) Consider the Wein Bridge Oscillator circuit shown below (the amplitude limiting part has not been shown for simplicity)



a) Determine the oscillation frequency of the oscillator.

b) Find the condition for oscillations to be self-sustaining. $[3 + 3]$

Q 3) Consider the Hartley oscillator shown below. The input impedance of the amplifier can be considered infinite.



Given the parameter values $L_1 = L_2 = 1$ mH and $C = 1$ nF,find

a) the oscillation frequency, and

b) the minimum gain that the amplifier must have in order for oscillations to occur. $[3 + 3]$