Industrial Electronics TP16

Design and Measurements (Time 1 hour)

B1 Measurement:

B1.1 Measure and record the resistance of the bulb supplied using a multi-meter. Specify the unit of resistance.

Measured value = _____ Unit_____ (Mark 0.5)

B1.2 a) Draw a schematic diagram showing a power supply connected to the bulb and meters monitoring the voltage to the bulb and the current flowing through the bulb.

(Mark 0.5)

b) Specify the voltage and current range setting of each meter. (Mark 0.5)

c) Specify a supply voltage. (Mark 0.5)

B1.3 Connect the bulb to the voltage source specified in B1.1c, record the voltage across the bulb and the current through the bulb.

a) Bulb voltage_____ b) Bulb current_____ (Mark1.0)

c) Calculate the value of the bulb resistance. Resistance _____ (Mark 0.5)

d) Comment in detail on the values of resistances obtained in B1.1 and B1.3c

(Mark 1.5)

Total = 5

Answer : d)

B2 Design:

B2 555 TIMER CIRCUIT.

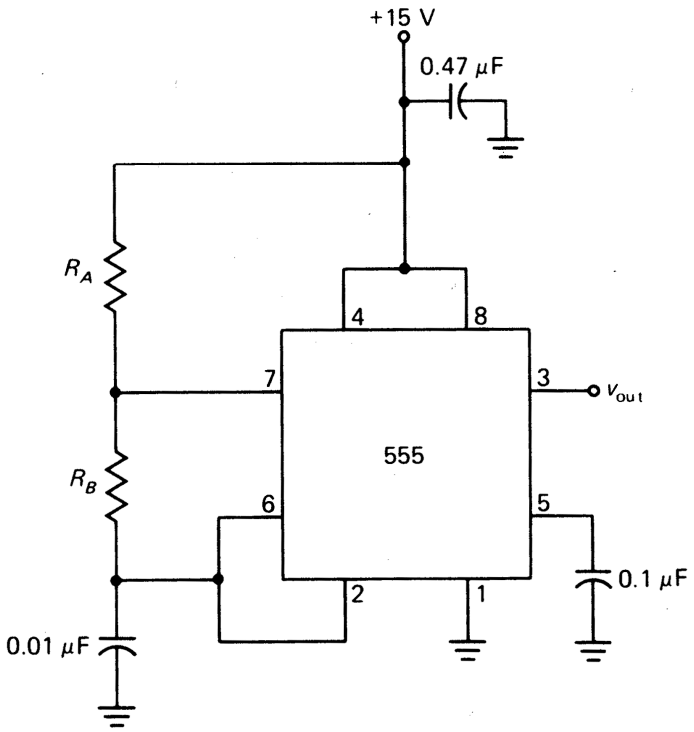

Figure 1

Equipment and materials:
Power supply, Resistors10k, 100k, Capacitors 0.01u, 0.1u, 0.47u, NE555, Oscilloscope
Frequency meter, Data sheet for 555

B2. 1 **Calculate** the frequency and duty cycle for the circuit in figure 1 for the Resistors listed in the table below:

R_A	R_B	F_{calc}	D_{calc}	$f_{measure}$	$D_{measure}$
10k	100k				
100k	10k				
10k	10k				

B2.2

Connect the circuit as shown in figure 3 with R_A = 10k and R_B = 100k. **Monitor** the output with an oscilloscope and measure and record the frequency.

B2.3 **Measure** the pulse width W. **Calculate** and record the duty cycle as the measured 'D' in the table above

B2.4 Record the **voltage** across the timing capacitor.

B2.5 Repeat steps 2 – 5 for the other resistor combinations in the table

B2.6 Demonstrate the **functionality** of the working circuit to a judge

B2 – 555 Timer	**B3 - Mark**
B2.1 – Calculations	1.0
B2.2 - Frequency	1.0
B2.3 - Pulse width	0.5
B2.4 - Voltage	0.5
B2.5 - Repeat	1.0
B2.6 - Functionality	1.0
Total	**5.0**

B3. Design

B 3.0 - OP AMP LEVEL SHIFTER.

Using the prototype board supplied construct an op-amp circuit. You are supplied with a 741 op-amp device, choose your own resistors. The 741 pin-outs are shown in Figure 2.

B3 - OP AMP LEVEL SHIFTER	B3 - Mark
B3.1 – Schematic Dia.	1.0
B3.2 – Calculation dB	1.0
B3.3 – Build quality	1.0
B3.4 – Graph	1.0
B3.5 – Functionality	1.0
Total	**5. 0**

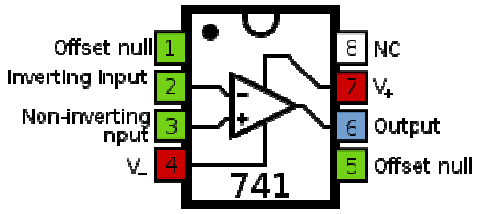

Figure2.

Convert a 1 kHz 0-2V square waveform on the input to a minus 9.4V output waveform
Design a suitable circuit using a 4k7 resistor and a 1K resistor to implement this.

B3.1

Show the **schematic** with all connections. Include decoupling capacitors on your schematic and prototype. Show how you generate the split (+/- 15V supplies) in your schematic using the power supplies available

B3.2

Show a **calculation** for the gain. Express the **magnitude** of the **gain in dB**.

B3.3

Build the circuit. Use the same breadboard as for parts 1 and 6.

B3.4

Graph the input voltage, the output voltage and the voltages at the positive input (pin 3) and the negative input (pin 2)

B3.5

Show the **functional** circuit to a judge with the input on Channel 1 of the scope and the output on channel 2.

Industrial Electronics TP16

Design and Measurements (Time 1 hour)

Question B3.4 Title---------- Competition No--------