COMPETITOR'S INSTRUCTION:-

C1.0 –ANALOGUE FUNDAMENTALS

Attempt all questions: Circle the letter that indicates the correct answer.

C1.1 The prefix '*nano*' stands for: (a) 106 (b) 103 (c) 10^{-3} (d) 10^{-6} (Marks 1.0)

C1.2 The voltage of 2,000 V can be expressed in powers of 10 as:

(a) 2 mV (b) 2 kV (c) 2 MV (d) 2 GV (Marks 1.0)

C1.3 The unit of power is: (a) Coulomb (b) Ampere (c) Volt (d) Watt (Marks 1.0)

C1.4 The voltage across a 100W bulb that delivers a current of 10 A is:

(a) 11 kV (b) 1100 V (c) 110 V (d) 10 V (Marks 1.0)

C1.5 a) Find the equivalent circuit resistance (R_{eq}) of the circuit shown in figure 1.
b) Which parallel network current is the largest? Mark 2.0)

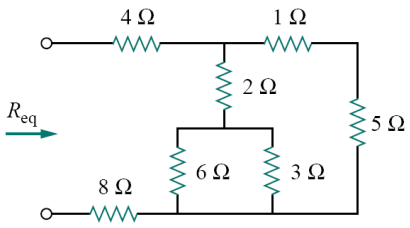

Figure 1

Answer:

a)

b)

C2.0 TRANSISTOR AMPLIFIER.

A common emitter amplifier has the schematic as shown in Figure 2. Components R2 and R4 values are not shown. Build circuit onto the breadboard using a PN2222 transistor.

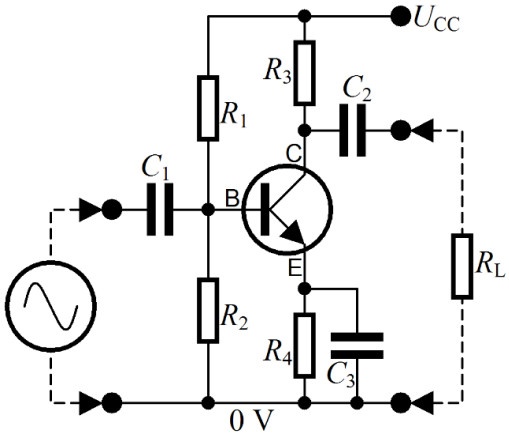

Figure 2

C1, C2, are 10 µF, C3 is 100uF and C4 is 0.1µF

R1 100K R2=? R4=? R3 = 4K7 RL= 100K

Power Supply voltage is 20V, Input Signal 28m V **rms** at 10 kHz Sine-wave.

C2.1 Calculate a suitable value of **R2.** (Marks 1.0)

C2.2 Calculate the value of **R4** so that the emitter current is approx 2.16mA. Take V_{BE}=0.7V. Show your calculation. Choose **the closest preferred value** of resistor. (Marks 2.0)

C2.3 Determine the theoretical ac gain of the circuit. **Write down a formula** to support your answer. (Marks 3.0)

C2.4 Calculate **VC** the dc voltage at the collector. Show calculation (Marks 1.0)

C2.5 Build the circuit. Now apply a signal of 28m V **rms,** frequency 10 KHz to the input. (Marks 1.0)

C2.6 Measure the output waveform with an oscilloscope and **graph the waveforms**. On your graph state the **peak value of the input and the output** and determine the **gain** as a number. Also check quiescent value of V_C (Marks 3.0)

C2.7 Demonstrate the **functionality** of the working circuit to a judge. (Marks 1.0)

Question---C2.6------- Title---------- Competition No.--------

C3.0 ACTIVE FILTER:

Predict how the operation of this active filter circuit shown on figure 3 will be affected as a result of the following faults. Consider each fault independently (i.e. one at a time, no multiple faults):

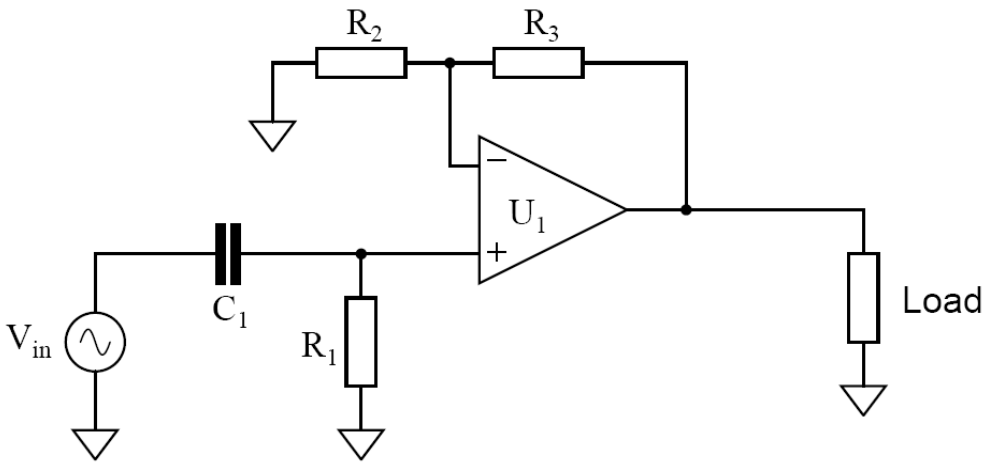

Figure 3

For each of the following fault conditions, briefly explain why the resulting effects will occur.

C3.1 Resistor R1 fails open: (Marks 1.0)

C 3.2 Capacitor C1 fails open: (Marks 1.0)

C 3.3 Solder bridge (short) across resistor R1: (Marks 1.0)

C 3.4 Solder bridge (short) across capacitor C1: (Marks 1.0)

C 3.5 Resistor R2 fails open: (Marks 1.0)

C 3.6 Resistor R3 fails open: (Marks 1.0)

Answer:

C3.1 Resistor R1 fails open:

C 3.2 Capacitor C1 fails open:

C 3.3 Solder bridge (short) across resistor R1:

C 3.4 Solder bridge (short) across capacitor C1:

C 3.5 Resistor R2 fails open:

C 3.6 Resistor R3 fails open:

Digital Fundamentals

C4.0 – KARNAUGH MAPS

C4.1 **Simplify** the logic represented by the circuit shown in figure 5 using a Karnaugh map

(Marks 3.0)

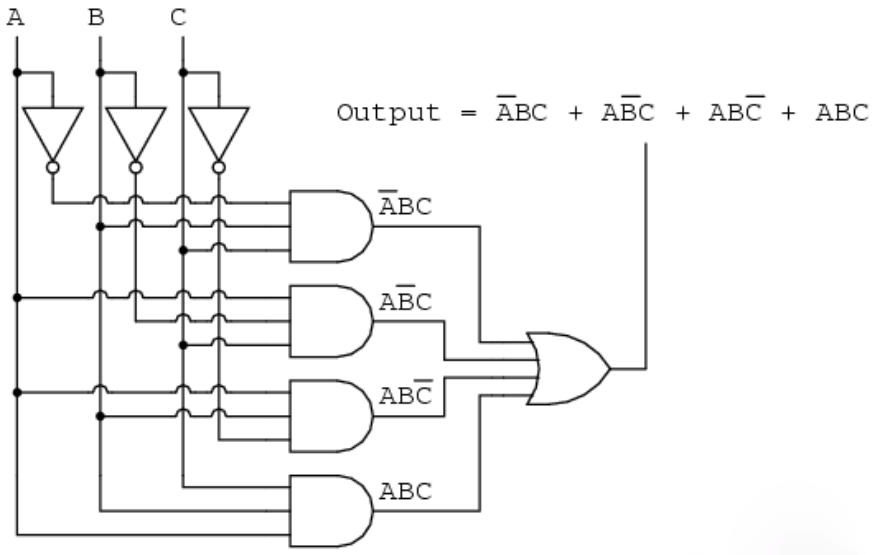

Figure 5

C4.2 **Draw** the simplified circuit (Marks3.0)

C5.0 - 4 BIT COUNTER.

C5.1

Design and Build a 74161 counter that repeatedly counts from 0000,0001,0010,...., 1110,1111,0000, etc. Draw the Schematic of the counter and clearly show all connections. You are supplied with the following information:-

74161 Counter (see datasheet)

10 Green LEDs (AGILENT HDSP4850) in a package

220 Ohm current limiting resistor s for the LEDs.. (Marks 4.0)

C5.2

Test that the Counter is working with an appropriate TTL input and monitor the **waveforms** on the scope of the four outputs. (Marks 4.0)

C5.3

Have a judge to examine the counter, show with a suitable low frequency input that the counter pattern is **working** on the LEDs. (Marks 2.0)