QUIZ SOLUTION

Name: _____ **Roll No.** **Section:**

Lab Quiz Room No. : **Seat No.:**

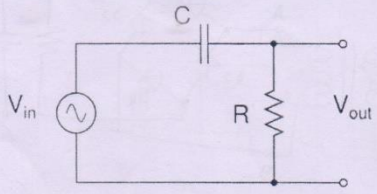
MS101 – Makerspace
2022-23/I (Autumn Semester)

Dec 30, 2022 (Fri) **Lab Quiz - 1 (EE)** **Time: 45 min**

Marks: 30

1. This **Question-cum-Answer Booklet** has 4 pages.
2. Write your **answers only in the space provided for answers**. Answers written at any other place will not be checked. You may use the page margins for rough work.
3. No explanations/clarifications will be given to any of the questions.
4. No negative marks for wrong answers.

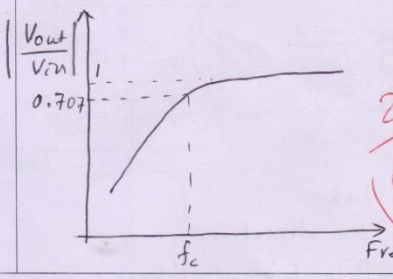
1. The circuit diagram of an RC high-pass filter is given below. For a sinusoidal input voltage, sketch the magnitude of V_{out}/V_{in} as a function of frequency. The cut-off frequency of the filter is $f_c = 1/(2\pi RC)$. The component values are: C = 1 μF, R = 1 kΩ.



Marks: 3 (=1 + 2)

Answer: f_c = 159.15 Hz 1

Sketch:



2

(Deduct 0.5 marks for each mistake)

(0.5 marks → correct shape; 1.5 marks for fc, and peak and 0.707 points)

2. State whether the statement is '**True**' or '**False**'

To observe a test signal on the DSO using the DSO probe, one can interchange the Probe-signal lead and the Probe-GND lead, as that will not make any difference.

Marks: 1

True/False: FALSE 1

3. In order to observe a small ripple voltage superimposed on a large DC voltage (say 50 mV AC voltage superimposed on a 20 V DC voltage), the best way to observe the ripple voltage on the DSO channel CH1 is:

A) to put the CH1 coupling mode as DC and to choose 20 mV/division on CH1 scale.
B) to put the CH1 coupling mode as AC mode and to choose 20 mV/division on CH1 scale.
C) to put the CH1 coupling mode as DC mode and to choose 10 V/division on CH1 scale.
D) to put the CH1 coupling mode as AC mode and to choose 10 V/ division on CH1 scale.

Marks: 1

Correct option: B 1

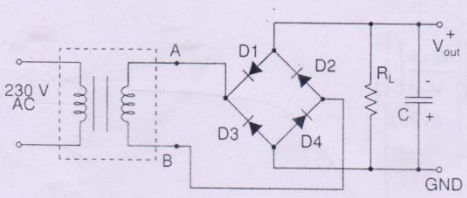
4. When a DSO channel coupling mode is put as 'DC',
   A) one will be able to observe only the DC voltages as AC voltages are filtered out.
   B) one will be able to observe only the AC voltages as DC voltages are blocked.
   C) one will be able to see the waveform as it is with its DC and AC voltage components.
   D) one will see only the average value of the waveform.

Marks: 1
Correct option: C 1

5. A student connected a sinusoidal test input to the DSO CH1. The display on the DSO was not stable (i.e. the display was not steady, but moving). The problem was diagnosed correctly as improper triggering. In order to get a well triggered waveform without using the 'AutoSet' option, one should
   A) use the 'Trigger' menu and chose the 'Trigger Source' as CH1.
   B) use the 'Trigger' menu and chose the 'Trigger Source' as CH1, and also adjust the Trigger level.
   C) use the 'Trigger' menu and chose the 'Trigger Source' as CH2.
   D) use the 'Trigger' menu and chose the 'Trigger Source' as CH2, and also adjust the Trigger level.

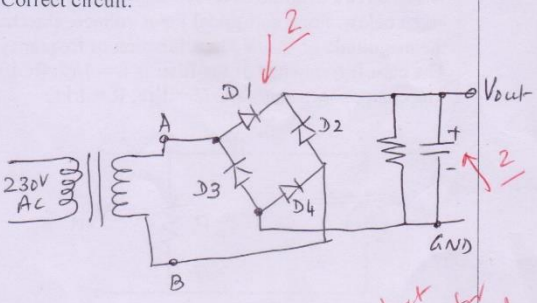
Marks: 1
Correct option: B 1

6. A student used the following bridge rectifier circuit with capacitive filter circuit. Unfortunately, there are two mistakes in the circuit. Draw the correct circuit.



Mistakes
1. D1 direction wrong
2. Polarity of C wrong

Marks: 4
Correct circuit:



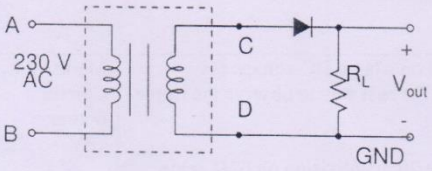
Correct Circuit

Deduct 0.5 marks for additional mistakes (if any)

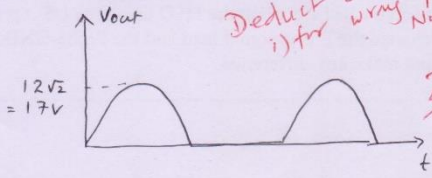
7. A half-wave rectifier circuit shown below has 230 V -to- 12 V step-down transformer.

(A) Sketch V_{out}.

(B) If the diode is now reversed, sketch V_{out}.

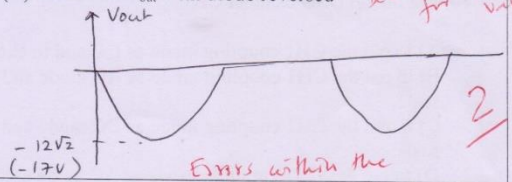


Marks: 4 (=2 + 2)
(A) Sketch of V_{out}



Deduct 0.5 marks i) for wrong peak value / No peak value

(B) Sketch of V_{out} with diode reversed

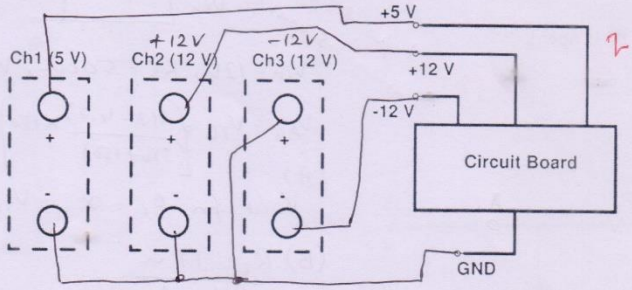


Deduct 0.5 marks for wrong peak value / no peak value

Errors within the - Diode drop ok

8. A circuit requires three supply voltages of +12V, -12 V and +5 V with a common circuit ground. We wish to use the Keithley Model 2231A DC Power Supply as used in the MS101 Lab. The figure below shows the power supply with the voltages set as indicated. Show the connections from the power supply terminals to the circuit board.

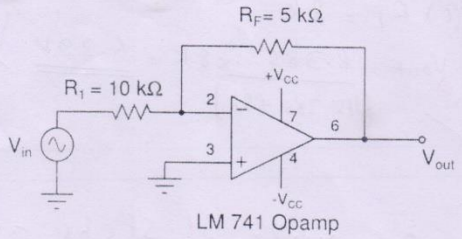
Marks: 4

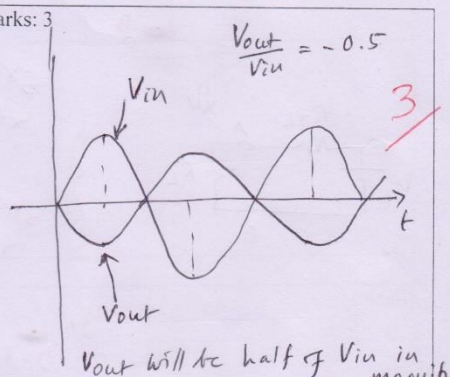


2 marks for the correct GND connection
2 marks for other connections

9. The op-amp amplifier circuit shown below has sinusoidal input voltage. Sketch on the same scale the typical waveforms of V_{in} and V_{out}.

Marks: 3



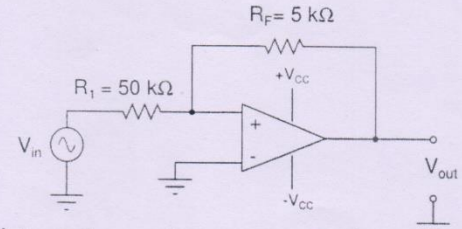


V_{out} will be half of V_{in} in magnitude

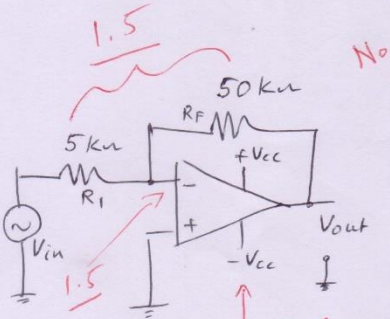
10. A student wired the following circuit for obtaining a voltage gain (V_{out}/V_{in}) of -10. The circuit did not work as an inverting amplifier.

Rectify the mistakes in the circuit diagram to obtain a voltage gain of -10. Do not use any other extra components other than what is already given in the figure.

Marks : 3



Mistakes: 1. R_1 and R_F got interchanged
2. op-amp inputs '+' and '-' got interchanged.



No partial marks

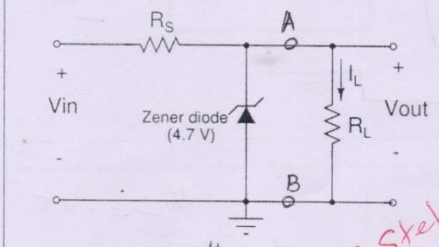
Do not deduct marks for supply interchange (i.e. if they have interchanged $+V_{CC}$ and $-V_{CC}$)

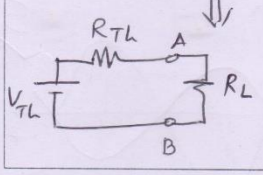
11. A Zener regulator circuit is shown below. The Zener voltage is 4.7 V, and the Zener I-V characteristic is linear in the Zener region with a slope of 150 ohms. Given: V_{in} = 12 V, R_S = 500 ohms. Showing steps of your calculations, find V_{out} for the following:

(A) $R_L = \infty$ (i.e. R_L is open).

(B) R_L = 1 kΩ.

(C) R_L = 8 kΩ.

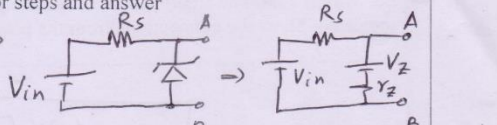




Marks: 5 (=3+1+1)

Space for steps and answer

V_{TH} ⇒



(A) steps 1.5 marks
Answer 1.5 marks

V_{in} = 12V, R_S = 500Ω, V_Z = 4.7V, Y_Z = 150Ω

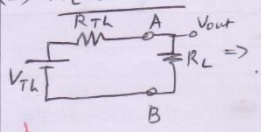
$V_{AB} = V_{TH} = \left[\frac{(12-4.7)}{(500+150)} \times 150\right] + 4.7 = 6.3846V$

$R_{TH} = R_S \| Y_Z = 115.385\Omega$

(A)

V_{out} for $R_L = \infty$ $= V_{TH} =$ 6.38V

(B) R_L = 1kΩ



$\therefore V_{out} = \frac{6.385}{[(115.385)+1K]} \times 1k$

$= 5.72V$ ✓

(C) R_L = 8k

$V_{out} = \frac{6.385}{[115.385+8k]} \times 8k = 6.29V$ ✓

Steps required

Steps required.

Blank space

Deduct 0.5 marks, if steps are not shown