



NATIONAL OPEN UNIVERSITY OF NIGERIA
14/16 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS
SCHOOL OF SCIENCE AND TECHNOLOGY
JUNE/JULY EXAMINATION

COURSE CODE: PHY364

COURSE TITLE: ELECTRONICS II

TIME ALLOWED: 2 hours

INSTRUCTION: ANSWER QUESTION ANY FIVE QUESTIONS

QUESTIONS ONE

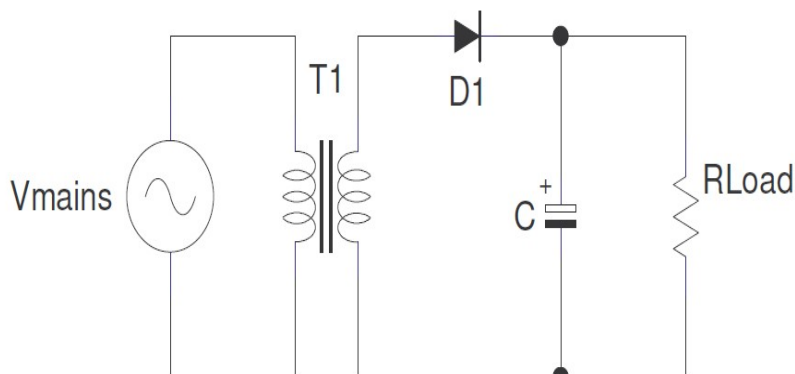


Fig 1

- a. Figure 1 shows the circuit diagram for a simple d.c. power supply. Identify the type of rectifier circuit represented in figure 1 and explain the operation of the circuit with reference to the function of each component within the circuit.
- b. Sketch the voltage across R_{Load} as a function of time showing its relationship to the secondary voltage from the transformer.
- c. The transformer is connected to a 220 V rms mains supply at 50 Hz and has a step-down turns ratio of 10:1. Calculate the peak secondary voltage from the transformer.
- d. Assuming a 10% ripple voltage across the load, calculate the peak to peak amplitude of the ripple voltage.

- e. Explain how the circuit could be modified to produce a 5% ripple voltage.
- f. The power supply unit shown in figure 1 is said to be unregulated -Explain the meaning of the term unregulated as used in relation to powersupplies.

QUESTIONS TWO

- a. The figure below show how a three terminal regulator chip may be used to provide a regulated output voltage.

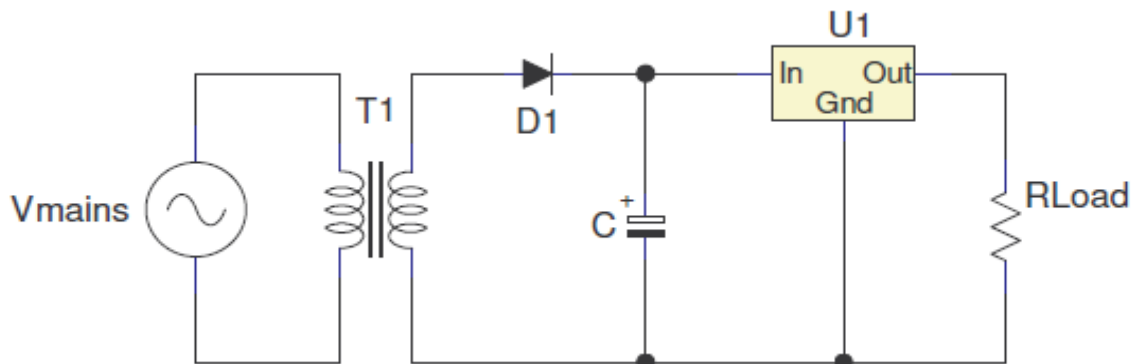


Fig 2

- i. How can a better result be achieved in terms of rectification
- ii. In relation to power supply units, explain the meaning of the terms percentage load regulation.

b.

Figure 3 shows a bipolar junction transistor (BJT) used to switch a lamp (L1) on and off in response to the output voltage from a programmable logic controller (PLC). V_s switches between 0 V and 5 V as the PLC output changes state. The BJT is specified with $I_{DC} = 150$ and $BV_{CEO} = 50$ V. The lamp is rated at 0.5 W when supplied from a 20 V source.

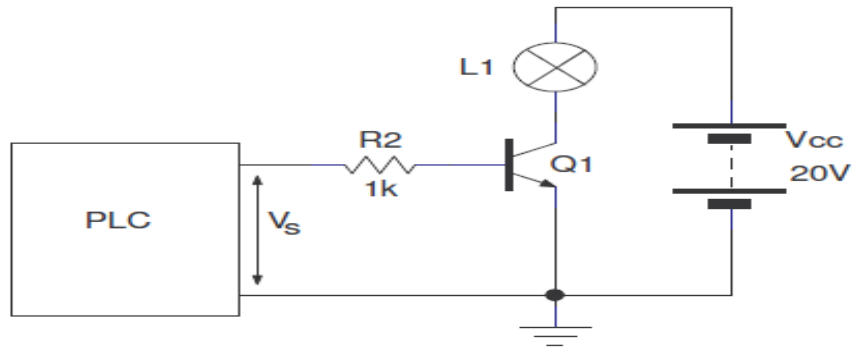


Fig 3

Calculate the base current in the BJT when:

- i. The PLC output is 0 V.
- ii. The PLC output is 5 V.

c.

Calculate the collector current needed to turn the lamp on fully. Hence, determine if the PLC output will be powerful enough to turn the lamp on fully using this interface circuit.

d.

Explain the consequences for the BJT if a large amount of power is dissipated and describe a technique that may be used to minimize the effect.

QUESTIONS THREE

a.

A MOSFET is biased such that $g_m = 1.78 \text{ mA/V}$ and $I_D = 1 \text{ mA}$. If V_{GS} changes with 1 mV, by how much does the drain current change?

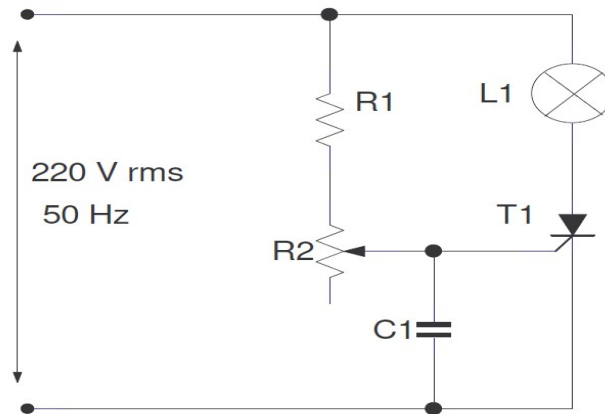


Fig 4

- b. Identify the type of electronic component represented by each of the symbols shown in figure 4 above and state the function of the circuit.
- c. Briefly describe the principle of operation of the device T1 including an explanation of how the device is made to turn on and off.

QUESTIONS FOUR

a.

A junction transistor whose parameters are $r_{11} = 820\Omega$, $r_{12} = 800\Omega$, $r_{21} = 1.98\text{M}\Omega$ and $r_{22} = 2\text{M}\Omega$ is used in a single –stage, common-emitter amplifier, with a load resistance of 430Ω . Calculate;

- i. The voltage gain
- ii. The current gain
- iii. The input resistance

b.

Classify the following filter as active/passive and lowpass/high-pass,

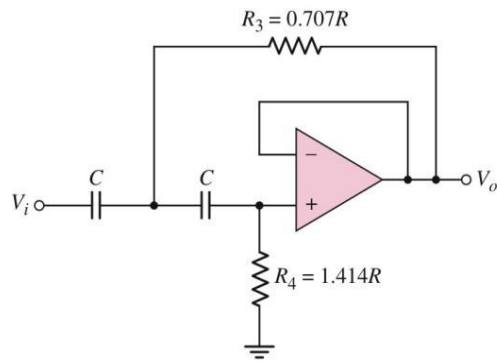


Fig 5

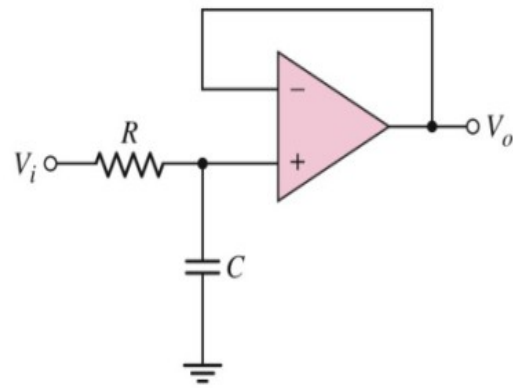


Fig 6

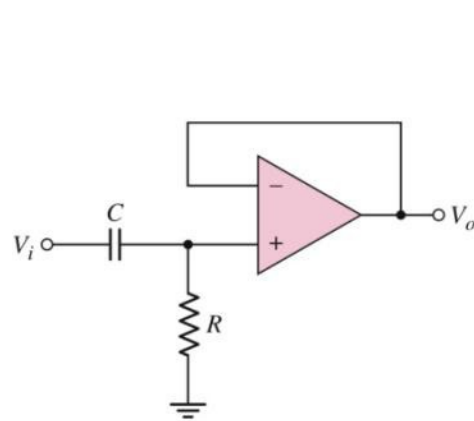


Fig 7

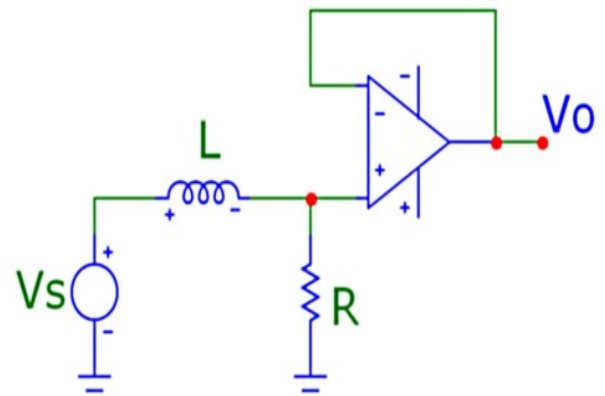


Fig 8

QUESTIONS FIVE

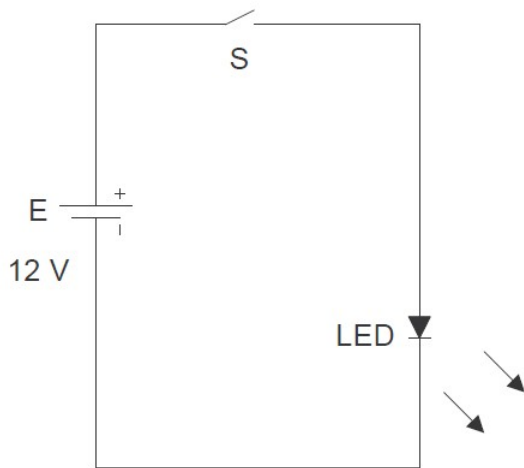


Fig 9a

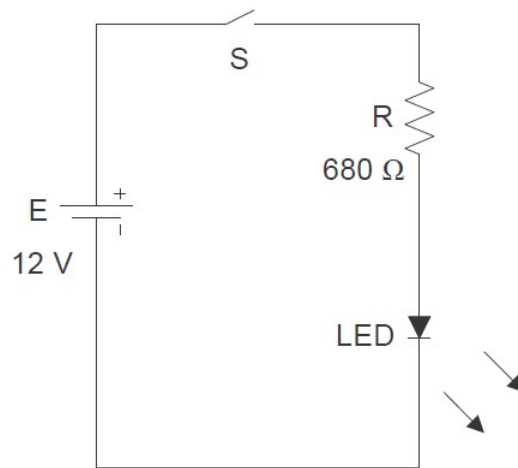


Fig 9b

Resistors are often included in electrical circuits in order to control the amount of current flowing in a sensitive device.

- a.** Explain the following parameters in relation to resistors –
 - i. Nominal value
 - ii. Tolerance
 - iii. Power Rating
- b.** State typical values for the voltage across a light emitting diode(LED) and the current flowing through it when operated normally.
- c.** With reference to the circuit in figure 9(a), explain the likely consequences for the light emitting diode (LED) of closing the switch.
- d.** With reference to figure 9(b) -
 - i. Explain how the resistor R in series with the LED restricts the diode current to a safe level when the switch is closed.
 - ii. Calculate an approximate value for the current flowing in the LED.
 - iii. Calculate the power dissipation in the resistor R.

QUESTIONS SIX

a.

- i. How can you reduce signal distortion in amplifiers?
- ii. Explain the function of biasing diodes in a class B bipolar transistor amplifier?
- iii. Each diode in a center-tapped full-wave rectifier is _____-biased and conducts for _____ of the input cycle.

b.

- i. The transistor amplifier that provides the greatest input impedance is known as?
- ii. An engineer designs a class-AB amplifier to deliver 2 W (sinusoidal) signal powers to an 8Ω resistive load. Ignoring saturation in the output BJTs, what is the required peak-to-peak voltage swing across the load?

c.

The probable trouble, if any, indicated by these voltages is:

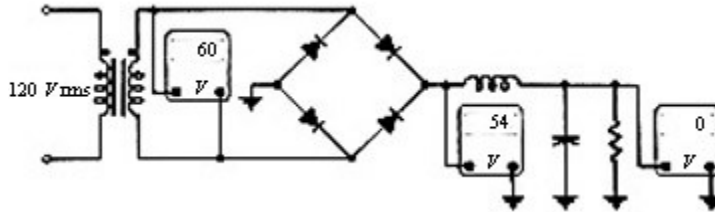


Fig 10

QUESTIONS SEVEN

a.

- i. The output frequency of a half-wave rectifier is _____ the input frequency.
- ii. If the ac supply is 60 Hz, what will be the ripple frequency out of the half-wave rectifier?
- iii. If the ac supply is 50 Hz, what will be the ripple frequency out of the full-wave rectifier?
- iv. Explain the correct relationship between emitter, base and collector currents?

b.

- i. Filters with the _____ characteristic are useful when a rapid roll-off is required because it provides a roll-off rate greater than 20/dB/decade/pole.
- ii. Refer to the given figure 11. This circuit is known as a _____ filter, and the f_c is _____.

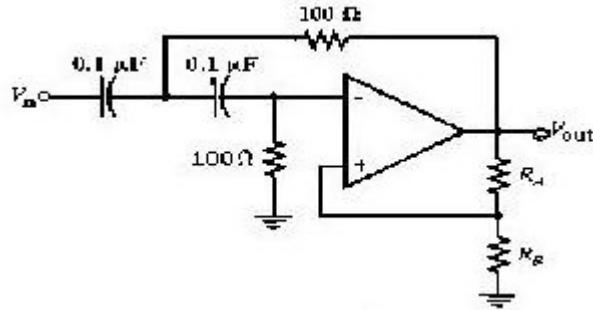


Fig 11

c.

- i. Which filter exhibits a linear phase characteristic?
- ii. Which filter exhibits the most rapid roll-off rate?
- iii. Which filter has a maximally flat response?