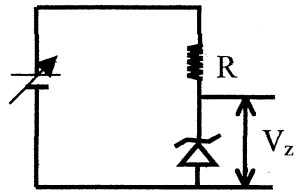
The Open University of Sri Lanka
B.Sc./B.Ed. Degree Programme Level - 05
Final Examination – 2014/2015
PCU 1170/ PCU 3170 – Electronics for Biology Students
Duration: Two (2) hours

Date: 5th May 2015 **Time: 1.00 p.m- 3.00 p.m**

Answer four (4) questions only

(1). (a) Draw the characteristic curve for the current against the voltage of a 6.2 V Zener diode.

In the following circuit, a 6.2 V/ 0.5 W, Zener diode is used to obtain a fixed voltage (V_Z) from a variable dc power source, which changes from 8 V to 12 V.



(b) What would be the maximum current through the Zener diode?

(c) Hence find the lowest value for the resistor *R* at the maximum supply voltage.

(d) What is the current through the circuit at the minimum supply voltage for the above value of *R*?

(e) Give a practical application of a Zener diode in an electronic circuit.

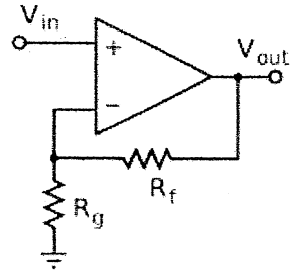
(2). Operational amplifier is a useful Integrated circuit (IC) used in analogue electronic circuits.

(a) Write down three input/output characteristics in an ideal Operational amplifier.

(b) What are the two golden rules applicable for an ideal operational amplifier?

(c) The following figure shows the circuit diagram of a non-inverting amplifier circuit.

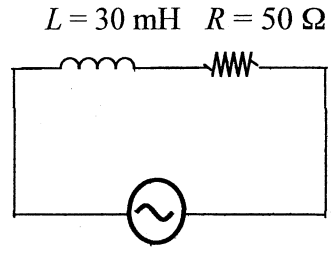
Derive the voltage gain ; $\frac{V_{out}}{V_{in}} = (1 + \frac{R_f}{R_g})$ using the golden rules.



(d)The resistors used in the above circuit is arranged to obtain the voltage gain of +350. Add another operational amplifier stage to obtain the voltage gain of – 700 as the final voltage gain.

(e) Explain the purpose of using off set null arrangement in an operational amplifier circuit.

(3). An inductor (L) and a resistor (R) are connected in series with a signal generator, which produces sinusoidal voltage signal.



$V = 10 \times \sin (5 \times 10^3 t)$ V

(a) Find the impedance of each component (R & L).

(b) What is the resultant impedance of the circuit.

(c) Calculate the peak current through the circuit and hence find the peak voltage across each component.

(d) Draw the phasor diagram for the circuit using voltage across each component and hence find the phase angle of the resultant voltage relative to the current of the circuit.

(4). (a) Write short notes on primary and secondary cells.

(b) Draw the circuit diagram to convert a 230 V/50 Hz voltage signal to a 12 V/100 Hz full wave rectified voltage signal.

(c) Draw the voltage – time graph for the above output after connecting a 1000 μF capacitor across the output, calculate and indicate the peak to peak voltage of the ripple of the signal.

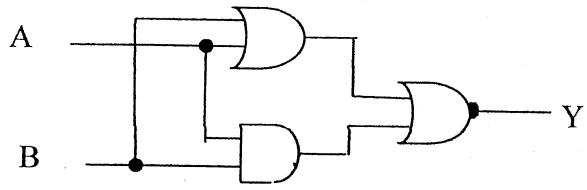
(d) Connect a suitable voltage regulator IC to the above circuit to obtain a stabilized 5 V dc voltage output.

(e) What happen to the output voltage, if a smaller value capacitor is used instead of 1000 μF for the circuit you proposed in (d).

(5). (a) Write down the output states of OR gate and Ex-OR gate when both inputs are at high state (logic 1).

(b) State the De Morgan's theorems in mathematical form.

(c) Derive the Boolean expression for the output of the following circuit and simplify it.



(d) Give the truth table for the above circuit.

(e) Draw the circuit diagram of a full adder circuit to add two binary numbers and explain its operation using an example.

(6). (a) Connect two NOR gates as a R-S flp-flop and improve it with the clock input using two AND gates.

(b) In a J-K flip flop, the two input are set to high logic state (J = 1 & K =1). How does the output change with the clock pulses?

(c) Explain the function of set and reset terminals in a J-K flip flop.

(d) Draw the circuit diagram of a three bit ripple counter using J-K Flip flops.

(e) How do you reset the outputs to zero after five clock pulses?

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