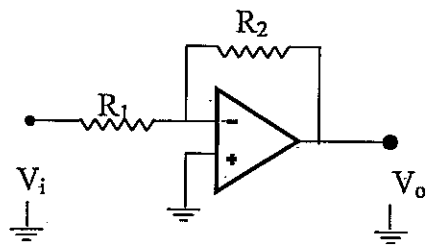
The Open University of Sri Lanka
B.Sc./B.Ed. Degree Programme - Level-03
Final Examination - 2010/2011
PCU 1170/PSU 1143 - Electronics for Biology Students
Duration : Two (2) hours

Date : 17th December 2010 **Time: 1.30 p.m.- 3.30 p.m.**

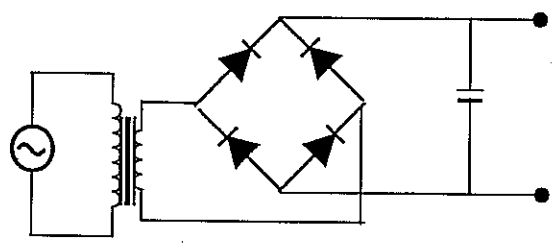
Answer Four(4) questions only

(1) The following figure shows the circuit diagram of an inverting amplifier.



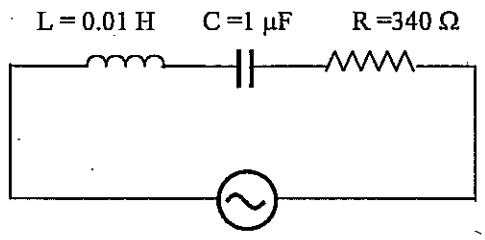
(i) Write down the equation for the voltage gain of the circuit and select the suitable resistors to obtain the voltage amplification of - 22.
(ii) The above circuit is activated by a dual power supply (± 15 V).
(a) If a sinusoidal signal with the amplitude of 100 mV is fed to the input, sketch the input and output wave pattern on the same graph indicating the amplitudes of signal on the voltage axis.
(b) "When a dc voltage signal with the amplitude of 0.8 V is connected to the input, it produces the output less the expected value". Verify this statement .
(iii) How do you modify the above circuit to obtain variable voltage gain?

(2) The following figure shows the primary stages of a low voltage power supply.



(i) Name each component indicated in the figure.
(ii) Sketch on the same graph, the voltage wave pattern with the time at the each stage
(iii) Numerically compare the ripple voltage at the output of the above circuit for two different values of capacitors (100 μF and 1000 μF).
(iv) Redraw the above circuit with the additional component required to obtain stabilized 6 V power supply.

(3) The following figure shows an alternative current circuit consisted of ac voltage source V = 250 cos(3500 t) mV , an inductor (0.01H), a capacitor (1 μF) and a resistor (340 Ω).



V = 250 cos(3500 t) mV

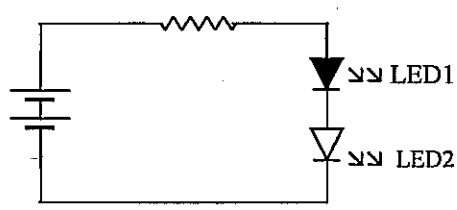
Total impedance

$$Z = \sqrt{R^2 + \{(\omega L - (1/\omega C)\}^2}$$

Where ω is the angular frequency

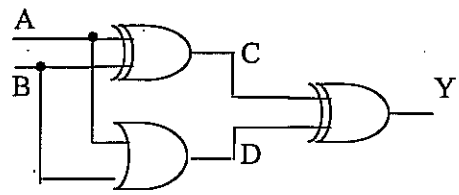
(i) Calculate the total impedance of the circuit.
(ii) Considering the peak voltage of the power source, find the peak current through the circuit. Hence calculate I_{rms}.
(iii) Draw the phasor diagram of the voltage across each component.
(iv) Derive the equation for the resonance frequency using the given equation for the total impedance and calculate its numerical value.

(4) The following circuit shows an arrangement of dc power supply, a resistor and two coloured LEDs (LED1= 2.7 V/ 30 mA and LED2 = 3.5 V/ 30 mA)



(i) If the above circuit is activated with a 9V battery, calculate the value of the current limiting resistor used in the circuit.
(ii) What would be the minimum wattage of the resistor?
(iii) Considering the wattage of each LED compare the light intensity emitted by each of them.
(iv) If the battery consists of a 5 Ω internal resistance what would be the current in the circuit with the resistor selected in part (i) of the question ?
(v) If the charge of an electron is 1.6×10^{-19} coulombs, calculate the number of electrons passing through the resistor within 2 minutes.

(5) The following circuit is constructed to compare the output results of an OR gate and an exclusive OR gate



(i) Presenting the truth tables of the gates of OR and exclusive OR, derive the truth table for the output (Y).
(ii) Derive the Boolean expression for the output (Y) of the above circuit.
(iii) Using the derived Boolean expression, find the output state of the circuit for the inputs of A= 0 , B=0 and A= 1 , B=1.
(iv) Compare the outputs of OR gate and exclusive OR gate of the above circuit, when Y is high state and is low state.
(v) How would you improve the above circuit to display the output, using an LED?

(6) (i) Draw the circuit diagram with an operational amplifier to amplify the light incident on a photodiode of a colorimeter instrument.
(ii) How do you correct the problem for non zero voltage at the output for the dark light on the detector ?
(iii)Explain how the increment of the feedback resistor in the circuit effects the accuracy of the colorimeter.
(iv) Briefly explain how a LED with a particular colour is more suitable compared to a tungsten filament bulb to use in a colorimeter.
(v) Briefly explain the function of a blank solution used in the colorimeter measurements.

//