The Open University of Sri Lanka
B.Sc. Degree Programme Level-04
Final Examination – 2011/2012
PCU 1170/PSU 1143 – Electronics for Biology Students
Duration: Two (2) hours

Date: 23rd December 2011 **Time: 1.00 p.m.- 3.00 p.m.**

Answer Four (4) questions only

(1) (a) The colour bands of a resistor towards the gold colour ring are Brown, Red and Orange. Find the resistance and the tolerance of the resistor.

(b) Suppose you have many 12 kΩ resistors. How do you construct a 28 kΩ resistor only using given resistors?

(c) Show that the power dissipation of the bulb in the circuit shown in Fig. 1 is given by,

$$W = \frac{E^2}{R + 2r + r^2/R}$$

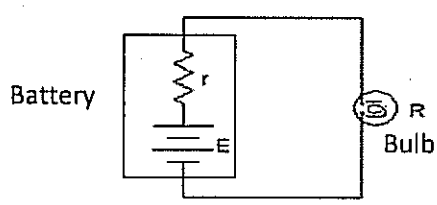


Fig.1

Hence show that the maximum power transfer occurs when R = r.

(d) What is the wattage of the torch bulb that you recommend to get the maximum light from a torch operated by two 1.5 V batteries when the internal resistance of a battery is 0.05 Ω?

(e) Find the Thevenin's equivalent circuit across the points A and B of the circuit shown in Fig.2.

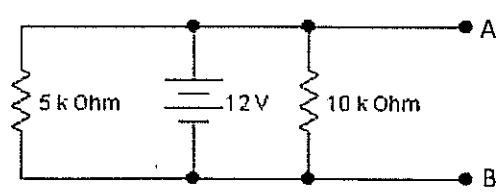


Fig.2

(2) The signal generator produces an ac voltage signal; V= 0.8 sin(500πt) volts in the circuit shown in Fig.3.

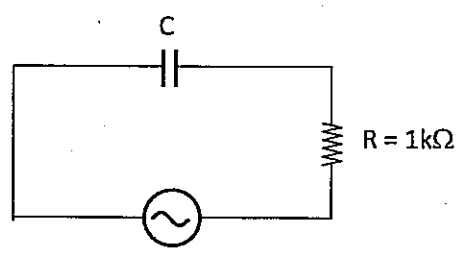


Fig.3

(a) Find the following parameters of voltage signal produced by the generator.
(i) Peak voltage (ii) angular frequency(ω) (iii) Period (T)

(b) Write down the impedance of the circuit terms of R and C.
(c) Calculate the total impedance and find the peak current through the circuit.
(d) Draw the wave patterns of the voltage signal across the resistor and the capacitor showing their relative phase difference.

(3) (a) How do you identify a pnp and npn transistor with their circuit symbols?
(b) How do you bias the two junctions of a transistor in a transistor amplifier circuit?
(c) What is the purpose of two capacitors C_1 and C_2 in the following single stage amplifier circuit (Fig.4)?

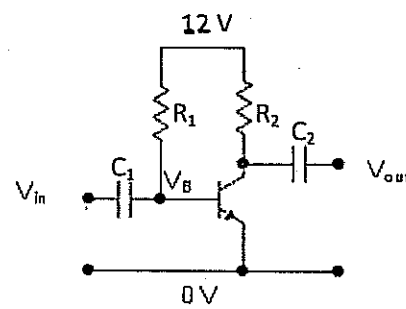


Fig.4

(d) Calculate a suitable value for R_1 to set V_B at 0.7 V.
(e) Recommend a suitable value for R_2 to avoid any voltage clipping at the output if the current gain of this circuit is 100.

(4) (a) How does the doping enhance the conductivity of semiconductors?
(b) How do you make p-n junctions with semiconductors?
(c) What is meant by forward bias and reverse bias of a p-n junction?
(d) Write down three devices with a single p-n junction.

(e) If an AC signal (sine wave pattern) of 9 V is input to the circuit shown in Fig.5, draw the output voltage pattern when the break down voltage of the zener diode is 6.2 V.

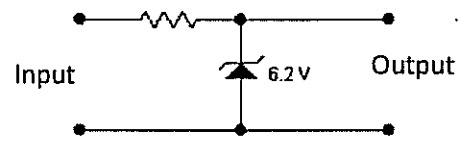


Fig.5

(5) (a) Compare the input impedance and output impedance of an ideal and real operational amplifiers.

(b) Why it is not possible to use open loop condition for operational amplifiers in general purposes?

(c) Show that the voltage at the output of the inverting amplifier shown in Fig.6 is given by,

$$V_o = -\frac{R_2}{R_1} V_i$$

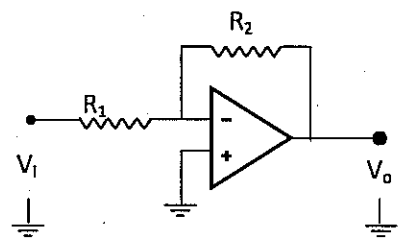


Fig.6

(d) An inverting amplifier circuit constructed with two resistors; $R_1 = 47\ k\Omega$ and $R_2 = 470\ k\Omega$ is operated using $\pm$ 12 V dual power supply. Sketch the graph for output voltage, for the input voltage range of -1.5 V to +1.5 V.

(e) Compare the input impedance and voltage gain of the op-amp circuits shown in Fig.6 and Fig.7. Consider that op-amp in there circuits are identical.

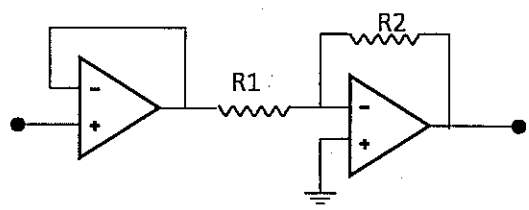


Fig.7

(6) (a) Write down the De Morgan's theorems.

(b) Write down the purpose of these two theorems?

(c) Construct the logic circuit shown in Fig.8 only with NAND gates.

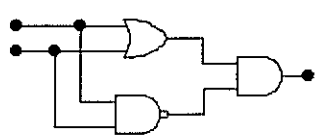


Fig. 8

(d) What is the difference between the combinational logic and sequential logic?

(e) Draw a S-R flip flop with two NAND gates and use it to develop the following circuits.

(i) Clocked S-R flip flop

(ii) J-K flip flop

(iii) D type flip flop

End.